

SEP 2 1918

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The AUTOMOBILE

Vol. XXXIX
No. 9PUBLISHED WEEKLY
NEW YORK, AUGUST 29, 1918Ten cents a copy
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AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

VOL. XXXIX

NEW YORK, THURSDAY, AUGUST 29, 1918—CHICAGO

No. 9

Airplane Delays Due to Lack of Co-operation and Experience

Appointment of Ryan as Second Assistant Secretary
of War Step in Right Direction

ARMY ORDERS FROM FRANCE CAUSED CHANGES

Engine and Plane Program Frequently Altered—Multitude
of Manufacturing Reasons for Delay

By David Beecroft

NEW YORK CITY, Aug. 28—Specific blame for the unfortunate failure of our aircraft program cannot be laid to any one individual. The blame can justly be spread not only over the entire civilian personnel connected with the problem, but also over the army and navy departments connected with it. The blame rests not only on these parties in America but partly must rest on those connected with this work in Europe.

This is the only conclusion that can be arrived at after studying the concise, yet fairly voluminous report of the sub-committee of the Committee on Military Affairs which spent months visiting the different aircraft factories and interviewing persons of all caliber connected with the airplane program. This committee also visited the testing fields and carried on other lines of investigation with the possible exception of investigating charges of personal dishonesty, or official corruption, which investigation is being carried on by Charles E. Hughes.

The report of the sub-committee is perhaps as complete as could be expected, as the committee

realizes the volume of the work before it. While the report is a pretty general denunciation of the complete airplane program, the humanness of the committee crops out when it declares that "your committee realizes that it is easier to criticise than to construct, and that due allowance should be made for mistakes of judgment, which are unavoidable in the organization of a new branch of the service, involving the establishment of an extensive industry. Our inquiry has been as impersonal as these conditions have permitted, and it is in the same spirit that this report is made."

The only possible deduction after studying the report and taking cursory glances at the 1226 pages of evidence obtained in questioning over 110 individuals connected with the aircraft work is that so long as it is human to err, scores, in fact hundreds, of the charges in the report must be ascribed to this human limitation. There is no thought in this of attempting to whitewash any individual in anywise connected with the design or production of airplanes. This statement is made because of the fact

that the delays in aircraft production were very largely because the airplane program, which we had to face after our declaration of war, had to be evolved under strenuous conditions.

It was a new and very highly technical industry in which our country had had a negligible experience. While as a people we had built some planes for peace purposes, we had never built a single combat machine; even our planes which were used in the Mexican campaign were for ordinary purposes and not for combat, so that our experiences in that episode counted for nothing so far as our airplane program is concerned.

It is impossible to agree with the tenor of the report which places practically all of the blame on the automobile industry and the evidence given does not bear out this exclusive condemnation. It is true that the automobile industry was not familiar with many of the problems connected with aviation, particularly that of plane design and construction. On the other hand, there was no group of manufacturers in America familiar with this work excepting small firms that had never had any experience in combat plane design or production.

The automobile industry has taken hold of the development of the Liberty engine and from the general approval of this type of engine, which is now less than 14 months old, and from the great orders which had been placed for it by the Allies, those criticisms by the committee of the industry become not only unmerited and unjust, but lead to the sole conclusion that the work of the committee seems to have been confined too much to the smaller concerns who have felt slighted in this Liberty engine program and who were slighted because of the lack of production capacity and of any organization to take hold of the work.

No stronger commendation of the work the automobile industry has done could be asked than the fact that the number of Liberty engines ordered has been increased from 22,500 to 50,000 and it is probable that orders will soon go as high as 68,000 engines for the next 12 months.

Further commendation of the same policy of the automobile industry in the question of engine design is the corroboration of the Liberty engine program by announcing that the eight-cylinder Liberty, which was originally developed in June and July, 1917, and set aside by army orders later, is now being taken up and will unquestionably fill an important place in our aviation engine program. It is impossible to understand why the Senate Committee should possibly lay the entire blame of the aviation program on an industry that has accomplished so much.

The British War Cabinet report in its chapter on aviation, published in AUTOMOTIVE INDUSTRIES some months ago, declared that it requires 12 months from the conception of the design of an aircraft engine until it is in production, and approximately 6 months for the development of a plane through the same stages. The American automobile industry far exceeded this estimate of a country which has been in war 4 years and has learned many lessons in

aviation engine design and construction because in less than 1 year the program of the Liberty engine for eight and twelve-cylinder designs was conceived, the eight-cylinder design was developed and then set aside, and the twelve-cylinder developed and put into production, so that over 4000 engines have been delivered.

With these as actual facts, the censure of the committee cannot be accepted as just and can only be interpreted as being biased due to the evidence of some who have not been as much in sympathy with the program as they should have been. To the critical reader the complete value of the report is lost in view of the failures of criticism to coincide with facts.

Had the report commented reasonably upon the difficulties connected with the development of production as the evidence indicates, we would have agreed that the deductions in the report were in accordance with the evidence at the hearings. On the other hand, the denunciations of the automobile industry are not even modified, but given the complete atmosphere of sole responsibility, in short the industry is blamed for everything, even the hundreds of things over which it had not the slightest control.

It was the human inability to grasp the magnitude of the aircraft program in June, 1917, that practically set the stage for the avalanche of criticism that has been heaped upon everyone connected with aircraft work since January, 1918, when it began to be made known that the program was anywhere from 3 months to 6 months behind schedule.

The real trouble started when those connected with aircraft made the announcement to the newspapers of the country at a dinner in New York City in May, 1917, that the confidential program would be to build perhaps 10,000 planes in the next year. Some of the daily press, not satisfied with 10,000 planes, swelled the number to 50,000, and in May, June and July of 1917 the country was more or less educated to the belief that it was within the range of possibility for America with its world reputation for production to put on the battlefields of Europe during 1918 as many as 100,000 airplanes of all denominations.

Unfortunately, the seed of American possibility of supremacy was scattered broadcast. The thousands of highways through the air to Berlin were accepted as a possibility by millions of our people.

Those in charge were but human beings of the same physical stature as of April 5, before we entered the war. It is true our entry into the war worked a great mental change, but it was impossible to carry out the visions of many who created the picture. *In a word, the aircraft personnel oversold itself.*

That the report, which is published in full in this issue, is certain to accomplish much good is shown by the appointment of John D. Ryan as Second Assistant Secretary of War, with complete responsibility for the army air service, which appointment is but one step upward in the certain program of having a cabinet officer in complete charge of the air service of the army and navy.

Mr. Ryan's appointment as Second Assistant Secretary of War means that the dual control which the government created on May 20 of this year, when Mr. Ryan was given direction of the Bureau of Aircraft Production and Major-General William M. Kenly was given charge of the Bureau of Military Aeronautics, comes to an end. This in itself is an acknowledgment of the humanity of our government, which failed to realize the stupendous problems of aircraft, and to-day realizes as a result of the present report that many of the delays have been due to incorrect organization, which can scarcely be laid upon the shoulders of the personnel carrying on the work under the specified organization. The end of this reorganization by Congress has not yet been reached, because to-day the army and navy aircraft program has not been centered in one man as it is certain to be.

Let us look at this human characteristic to err in perhaps a broader light: It is the easiest thing for our 80,000,000 people who have reached the age of manhood and womanhood to criticize the aircraft personnel for not doing exactly what England, France and Italy did in the manufacture of engines, airplanes, airplane equipment, and in all other matters relating to aircraft.

Why a British Air Service?

These criticisms may be just, but if we are to continue our criticisms we might ask, Why did not Congress duplicate identically the legislative organization of England, France or Italy? Why did we not create last year an air service? We can go further and ask: Why did not Great Britain create an air service in 1914 immediately after the declaration of war instead of having to wait until 1917?

There is but one answer, namely, that everybody connected with the air program in Great Britain is human, subject to error, and the same applies to everybody in America whether connected with the army, the navy, the government, or the civilian personnel of aircraft work.

From the hearing before the sub-committee of the Committee on Military Affairs, United States Senate, various reasons for delays in connection with the broad airplane program crop out in different parts of the hearings and the one conclusion is that these delays are so widely spread and cover so many different fields that the blame can only be laid to the enormity of the work, the highly technical



John D. Ryan

Who has been appointed Second Assistant Secretary of War with complete charge of the Army air service

character of the parts entering into it, and the general lack of experience on the part of all those connected with the work.

In this connection the reader must keep in mind the broad problem of aviation instead of centering perhaps his attention on the Liberty engine, which in publicity in the last year has been looked upon as the apex of our aviation program.

The engine is only a small part of the task. There are four to six quite different types of planes required for combat work and each of these is a huge problem in itself. There is then the adapting of an engine suitable for these. There is the development of a huge line of aircraft equipment embracing over thirty different kinds of apparatus with practically all of which we

were in total ignorance up to the time we declared war.

We had never built a machine for combat purposes and one that was intended to carry a machine gun, and it is not surprising that many delays were caused by this. Bombing devices had to be developed. The photographic task alone was a huge one. There was the development of all kinds of instruments for measuring speed, altitude, etc.

Previous to entering the war, our airplane engine production for the Allies was confined to building for training planes and we were in production on the 100 hp. Gnome and the 150 hp. Hispano-Suiza engine. One company had spent, according to its own admission, \$10,000,000 in practically 2 years in adapting the manufacture of Hispano-Suiza engines to meet American factory conditions and American workmen.

Lack of Skilled Mechanics

The lack of sufficiently skilled mechanics familiar with the manufacture of instruments and capable of interpreting and producing delicate instruments required for combat planes is but one example of the cause of delay in this line.

There was a great lack of engineering ability for the design and production of combat planes none of which had ever been built in America. Previous to the declaration of war the government had not demanded the development of production of a single combat plane. Under such conditions it is not surprising that under the strenuous atmosphere of April, May and June, 1917, this lack of experience should result in failure properly to map out a complete air program.



Col. Robert L. Montgomery



Howard E. Coffin



Admiral D. W. Taylor

In order to cope with the aircraft requirements the Aircraft Production Board, which was created in May, 1917, almost immediately sent a mission of army and navy officers and civilians to Europe to investigate aircraft methods in England, France and Italy, and to recommend types of engines, planes and accessories necessary for the work and to have samples of these planes, engines, instruments, accessories, and all necessary drawings, together with bills of materials, specifications and other necessities to this country in order to facilitate production.

Perhaps the great delay in the production of combat planes started at this time because samples of the planes recommended by this mission for manufacture here were not received in the United States until after September. When these samples arrived they were without engines with the exception of the Spad and many of the blueprints which accompanied them were inadequate for development according to American methods of quantity production.

Training Planes Speeded Up

These were five precious months in the aircraft program work and they were made use of by the Aircraft Production Board in speeding up the building of training planes and engines so as to meet our training requirements. The 3000 miles which separated the United States from the fighting front must always be considered as one of the reasons for serious delays.

There should have been organized in 1917 a weekly service between the technical departments of Europe, England, Italy and the United States. There should have been more of our engineers for engines and planes close behind the fighting front in France, so as to bring to America through our own channels correct recommendations regarding different types of machines.

The manufacture of accessories for combat planes is scarcely comprehended by any excepting a few directly connected with the work. These were the cause of serious delays. Other delays were due to the Ordnance and instrument equipment that was to go on these combat planes and this equipment was

not determined until December, 1917, or 8 months after the declaration of war.

Even the settlement of this equipment was not final and as late as January, 1918, the American Expeditionary Force ordered changes in this equipment and it was the middle of February before the Engineering Department of the Aircraft Production Board had these changes in its hands.

Some of these involved the mounting of two machine guns instead of one to fire through the propeller of the DeHaviland-4 plane, which, changed as late as February, 1918, called for a redesign of the fuselage cowl and arrangement of connections between the engine and various instruments.

Liberty Engine Design Changed

There were other causes of delay which relate more directly to the engine program. When plans were originally laid down for the Liberty engine on June 4, 1917, it was to be an eight-cylinder design, the first sample of which was running at the Bureau of Standards in Washington July 25.

Nearly a month later, or in August, 1917, cable advices from the Bolling Mission in Europe indicated that the development of aircraft was moving so rapidly on the battle front in France that the eight-cylinder engine would be obsolete before it could get into actual use and the Mission recommended a twelve-cylinder Liberty engine instead.

Immediately, the engineering organization of the Aircraft Production Board took up the development of a twelve-cylinder engine and it was entirely due to the fact that when the Liberty engine was conceived in June that it was to be so standardized that a majority of the parts could be used in four-cylinder, six-cylinder, eight-cylinder and twelve-cylinder design, that the development of the twelve-cylinder, which was begun in August, was able to proceed.

There were then delays that came because of the development of the twelve-cylinder engine. Originally it was intended with 5 x 7 in. cylinders to develop 330 hp., but this was soon increased to 400 hp. by virtue of improvement in the cams, intake manifolds and carburetion.

As this increase of horsepower continued, many of the original parts, such as connecting rods, bearings, etc., became too weak for the increased power, which called for a redesign of these parts to give increased strength. The redesigning of the connecting rod, in order to give increased bearing surface, called for a complete change in the dimensions of the rods which required the manufacture of new dies, tools and fixtures, which caused a serious delay in production. This delay was accentuated due to the great shortage of tool makers and die makers throughout the country.

The difficulties some of the manufacturers experienced in getting dies and fixtures constitute another chapter in the aircraft delay and one which cannot be laid at the door of any manufacturer.

165 Jigs and Fixtures Changed

An example of these delays was given by W. C. Leland of the Lincoln Motors Co., in which he mentions that the making of heavier bearings in the connecting rod called for a change of 165 jigs and fixtures. The difficulty of getting these was accentuated by the crowded condition of tool shops and the necessity of using inexperienced tool makers in many of these shops.

The Lelands employed the best tool makers it was possible to obtain in the country and yet many of these tools were rejected. They had to be made within 1/1000 in. accuracy and when they arrived they were 7/1000, 8/1000 and often 9/1000 out of accuracy. The Lincoln company had to make over many of these jigs and fixtures and had to build over practically every jig and fixture with its own workmen in the factory. At one time it had 83 different factories in the country, extending from Maine to Ohio and including Iowa and Illinois, manufacturing tools. This work was greatly increased by changes in the crankshaft and connecting rods as well as others in the propeller hub.

Unfortunately the public fails to even think of the enormous work of changing all of these jigs and fixtures and when it criticises it fails to realize the many steps in quantity production and the time and money required in getting a factory tooled and jigged for production manufacture.

Increase in Power Brought Trouble

There were many other troubles with the Liberty engine, most of which might be traced to the increase in power from the original 330 to the present 440 hp. There were difficulties with radiation, lubrication and carburetion. The original crankshaft was not an oil pressure one and the changing to an oil pressure system carried many changes with it.

As soon as the manufacture of different parts of the engine was passed on to the different manufacturers, many changes in parts were suggested by these manufacturers in order to make production possible.

The Aircraft Production Board, according to the evidence, heeded a great many of these changes, which naturally caused delay, but in the end worked for production.

One of these might be cited: The manufacture of the forged steel cylinders by the Ford company from tubing instead of from a solid forging as was used in the experimental engine. The use of the forging has proved to be one of the great manufacturing achievements in connection with our aircraft program.

There were many other delays resulting from a failure of quick communication between Europe and America and at this writing it would seem that a much more comprehensive mission should have been sent to study the aircraft situation in June of 1917 than was sent.

Here again it was human to err and unquestionably there was not a single person in America at that time to grasp the magnitude of the work sufficiently to select an adequate mission for the work. As a result, the necessary engineering information was not supplied promptly enough from Europe and the program lagged. This may be the reason why the engine program after all, although one of the biggest, outstripped that of ordnance and equipment for the combat planes.

Expected Too Much of Engine

There may be a just criticism in the fact that too much of the engineering talent connected with the Aircraft Production Board was sewed up in the design and development of the Liberty engine. Today it looks as if an error were committed in expecting the Liberty engine to fill the complete gamut of airplane requirement.

Perhaps it was an error to think that this engine made with four, six, eight or twelve cylinders would perform any phase of combat work at the front.

From the various hearings in the sub-committee report, the reader is apt to reach the conclusion that part of the program was held back pending the development of the Liberty engine and the proving of its suitability for all phases of work. For example, the development of heavy bombing planes does not seem to have made the progress it should and seems to have been delayed until the suitability of the Liberty engine for this work was decided upon.

This seems to be borne out by the report which says that in October, 1917, we had the necessary facilities to build the Caproni bombing plane and that as early as January, 1918, we had expert Caproni engineers in this country ready to proceed with the manufacture of this plane.

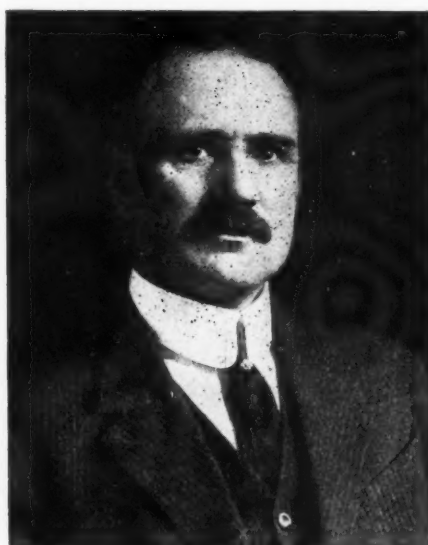
Delay in Transmitting Orders

Although so qualified to go ahead, it was not until Sept. 1 of this year that the first Caproni was constructed. As long ago as the summer of 1917 the Standard Aircraft Co., Elizabeth, N. J., was instructed to have its factory in readiness to build these Caproni machines, but nothing definite was decided upon.

As long ago as October, 1917, at Paris, France, the manufacture of the Caproni was taken up between our Mission and Italy and the apparent decision to go ahead was given; but notwithstanding this it was



Col E. A. Deeds



Charles W. Nash



W. C. Potter

January, 1918, before the Standard Aircraft company was given a verbal order to go ahead with 1400 of these machines, and at the date of the report no official order confirming the verbal order seems to have been given.

Lack of decision in connection with the production of this plane was further indicated by the fact that in April, 1918, the Fisher Body Co., Detroit, was given a contract to complete 250 of these planes, which contract was later canceled.

The report fails to bring out just why there was so much vacillation in connection with this Caproni program, but undoubtedly it was due to the lack of certain information or some policy connected with the work. For example, on Sept. 15, 1917, the Curtiss airplane corporation was given a verbal contract to build 1500 Capronis, which contract was confirmed in October. The Curtiss company appears never to have obtained the necessary information to go ahead and the contract was canceled later.

Automobile Industry Unjustly Censured in Senate Report

Failure of Government to Give "Go Ahead" Order Has Held Up Production—There Has Been No Profiteering, as Thinly Suggested in Report—Industry Has Done Well

By J. Edward Schipper

DETROIT, Aug. 27—*Special to AUTOMOTIVE INDUSTRIES*—In the eyes of the automobile industry the report of the Senate Committee on aircraft matters places the Government in the light of having bitten the hand that fed it. It is regarded as regrettable from every standpoint and particularly as a very bad preface to the coming Liberty Loan campaign when every ounce of public confidence will be needed.

Were the report true in spirit, it would not have caused the dismay in the industry that it has. "Where," it is asked, "would the government have turned in its efforts to find men of experience in engine production if it had not turned to the auto-

mobile industry?" Yet the industry is blamed for having turned over its facilities, disrupted its tool-rooms, disorganized its production schedules to enthusiastically and patriotically take up the manufacture of a product recognized to be the most difficult in the world to manufacture.

In spite of all difficulties the end of a year of work, Sept. 5, 1918, will see 20,000 airplane engines manufactured in this country. Of this 6000 are Liberty engines and the balance are made up of the Hispano-Suiza, Curtiss OX, Hall-Scott, Gnome and LeRhône types. The manufacturing schedule will total 3000 Liberty engines a month by the end of September. In addition to these there will be 1000 Curtiss and

600 Hispano-Suiza engines per month. Were it not for the automobile industry, what percentage of these would have been made?

At this very time, when the ways should be all cleared for the production of airplanes up to the very limit of productive ability, the full capacity of our plants is not being utilized. The natural tendency to stop action until the completion of an investigation is directly responsible for this.

The Fisher Body Co., with a capacity of twenty planes per day, has never been able to get "go ahead" orders enough to keep its plant going full swing.

The Ford Motor Co. could have been much further ahead in its production schedule than it now is if orders had been released.

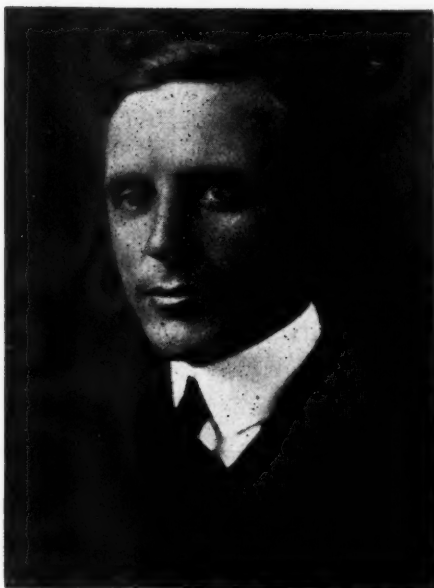
The automobile industry was ready and willing but vacillating policies prevented the throwing of full productive effort into airplane production.

The now-historic \$640,000,000 appropriation and the references to it in the report come in for bitter comment by some of the industry who were active in framing the original policy in regard to airplane matters. It is claimed that this appropriation was worked out by the army itself on an estimated production of 22,500 planes. There never was any prediction or expectation that this number was to be ready by July 1. The appropriation was worked out by General Pulloy and his technical board at the time of the framing of the appropriation bill. Of this number it was planned to order 5000 in Europe, 7000 were to be training planes and the remainder fighting planes. No one seems to be able to find any foundation in fact for the much-cited statement that this country would manufacture 22,500 planes by July 1.

What was predicted and what could have been done was to have reached a production of 1000 planes per month by July 1. Dayton-Wright alone could have reached 100 per day with 70 per cent spares or nearly 170.

Fisher could have been started, to say nothing of Curtiss and other plants scattered throughout the country. With investigations coming on, those vested with the power to order were naturally afraid to move with the result that men in the AUTOMOTIVE INDUSTRY WENT AHEAD AND ORDERED MATERIAL IN ADVANCE OF RELEASE ON ORDERS SO THAT PRODUCTION WOULD NOT SUFFER ON ACCOUNT OF THE DELAY. Yet, the automobile industry is accused in the report of being responsible for delay.

The bitterest pill of all to swallow is the thinly veiled accusation of profiteering. This is particularly true of the Liberty engine program. When the time came to fix a price on the Liberty engine there was nothing to go on except what had been paid for foreign airplane engines. These had been sold from



Col. Sidney Walden

\$20 to \$30 per horsepower. The Liberty engine with 450 hp. would have been estimated at \$9,000 at the lowest in accordance with foreign costs. Rolling White of Cleveland and Henry May, vice-president of the Pierce-Arrow, were called into consultation on the matter and at the suggestion of the Secretary of War estimated the cost. The figure placed by them was \$6,000 for the twelve-cylinder engine.

AFTER ENTERING INTO PRODUCTION THE MANUFACTURERS THEMSELVES WITHOUT DISSENT CUT THE ALLOWED COST FIGURE TO \$5,000. On this a flat profit of 12½ per cent was allowed.

Most absurd of all, in the eyes of the industry, is the claim in the report that we should have

gone ahead on quantity production of foreign types. Anyone who has had experience with past experiments in this field can see what this would have led to. The experience of the Wright-Martin company in manufacturing the Hispano-Suiza engine may be referred to, for instance. On an order for 400 of these engines, it took 18 months to get into production and after entering production, 4 months to turn out the 400 engines.

The experience of the Willys-Overland with the Sunbeam is another typical example. This company received in June, 1917, an order to build 1000 Sunbeams. Due to changes and imperfections in the drawings, but six motors had been completed in May, 1918. The airplanes of England, which has a production schedule of some 2800 per month, are produced in approximately 300 plants of various sizes scattered all over the kingdom. It is doubted whether any one of these plants could produce a complete set of detail construction drawings for any one plane. They are hand-made and far removed from the manufacturing proposition that American methods call for.

Handley-Page Delays

When the Handley-Page made its long flights and attracted attention to its flying qualities, it was decided to build that type of plane in this country. The Handley-Page company offered at a fancy price to supply its drawings and data for manufacture. Arrangements were then made with the British government over the heads of all commercial parties for the free exchange of manufacturing licenses for the period of the war and the drawings of the Handley-Page were sent over. A great number of dies were made by concerns like the Mullins Steel Boat, when a new set of drawings incorporating improvements were sent over and the whole set of dies had to be scrapped. This occurred three times before a proper set of dies for the metal fittings of this plane could be made. This all helped to spend some of the

appropriation and showed that we could not rely on foreign practice to help us much.

Even taking the best of foreign practice as represented in the Rolls-Royce engine. With 10,000 employees this company turns out 50 of these engines a week. The recommendation that we build this engine which does not equal in performance the Liberty and which falls short of its production facilities by the ratio of about 1 to 7, will hardly be carried out. The Rolls-Royce parts ordered by England to be made in this country are not being delivered now. With this difficulty in making the parts, it is easy to see what would have been encountered in

making the first engine. A total of 6000 Liberty engines in the first year looks large in comparison.

ENGLAND'S DESIRE FOR 20,000 LIBERTY ENGINES IMMEDIATELY IS ADDITIONAL INDORSEMENT IF ANY BE NECESSARY.

That the Senate Committee listened too much to small manufacturers who although they had engaged to some extent in the airplane business, were absolutely ignorant of war requirements and certainly of quantity production, is the belief of many. It is upon evidence of this kind, in the belief of these people, that the committee based its statements re-

(Continued on page 358)

Uncertainty Still Exists in Aircraft Program on Planes

We Are Still Adapting Discarded European Types—Foreign Engineer's Reports Not Accepted—Bristol Plane May Be Re-Adopted

By ALLEN SINSHEIMER

WASHINGTON, Aug. 27—The vague assurances regarding the immediate and future plans of our air program as told in the recent Senate report, combined with perplexing rumors of our activities in connection with Allied airplanes, still leave considerable uncertainty in the public mind, although the report has done much to clarify public opinion with regard to the earlier aircraft activities. The Senate's publication of the testimony of the witnesses in this matter has also helped to clear the atmosphere.

Rumors are current that a mistake was made in the selection of the SE 5 airplane which we have adapted from the British. It is said that the SE 5 was discarded by England in September, 1917, for the SE 5A, which has a higher speed and all around better performance. The SE 5A in turn, while still in use, was discarded for the Sopwith Camel which, in turn, has been discarded for the Sopwith Dolphin, which is now being replaced by the Sopwith Snipe. Each of these machines in turn has been regarded as superior to the preceding one by the British experts. Hence the public is asking why we have adopted the SE 5 long discarded by England.

Why the Bristol Failed

The failure of the Bristol airplane also arouses speculation. There is really no question about this. The American authorities simply took the Bristol airplane, which was designed by English experts for the 190 h.p. Rolls-Royce engine, which weighed 660 lb., and attempted to use it with the 450 h.p. Liberty engine weighing more than 950 lb. The excess weight and surplus power were not suited to the plane. Furthermore, the construction of the Liberty engine is entirely different from the Rolls-Royce and it occupied a greater width of space in the body

of the plane, which also had not entered into the calculations of its original construction. Consequently there was no surprise on the part of foreign experts when they learned that the planes fell away from the fuselage and that serious accidents had resulted. The attempts to use heavier fabric in this plane to counteract the heavier weight were not sufficient in them.

To Re-Adopt Bristol

And now after a year of experiment costly both in money and lives, comes the report that the American Government is again going to adopt the Bristol airplane equipped this time with the Hispano-Suiza engine. But strange to say, instead of adopting the latest Bristol type which is equipped with a 300 h.p. Hispano-Suiza, we are adopting the Bristol type used 2 years ago in England and long since discarded.

In his testimony before the Senate Military Affairs Committee, Major General Kenly spoke of the SE 5 as a two-passenger machine similar to the French Spad. He led Senator Reed to remark that it was strange that we had no single-seater. The SE 5 is really, according to authentic information, not a two-seater plane. It is a single-seated machine and differs in appearance, performance and horsepower considerably from the Spad.

An example of the lack of thorough co-operation between the experts and our authorities is shown in a recent instance where the most skilled foreign experts were called to this country to investigate and report on our training activities. They made an exhausted study and filed the report. This report has never reached the hand of Major General Kenly for whom it was intended, and up to this time the work performed by the men called from abroad has been wasted.

Foreign experts in this country are, of course, obligated by their position to refrain from criticism of our activities, but it is not difficult to learn that they are more or less discouraged and disgusted. Stories are told of how designs are brought in to them daily for their approval and even after they are O.K.'d are never used. Some of these designs, it is said, are foolish and a waste of time, embodying many unnecessary practices, such as sport and racing lines similar to designs of racing automobiles. Others embody exceedingly valuable principles, but since they are never converted into airplanes are merely wasted. It is also said that many of the engineers waste their time drawing these "beautiful" designs without ever taking into consideration the necessary calculations and dimensions.

Another example of our delay is found in the Caproni plane which Italy is turning out at the rate of several hundred a month. We have one Caproni plane finished. We might have had 2000 by this time had the authorities placed the orders a year ago. And now after months of delay and experiments and final completion of one machine authentic reports are to the effect that the orders just placed for Caproni machines have been cancelled and the entire Caproni program abolished. Following the experiments, tests and the excellent reports this action has created bewilderment and astonishment in the minds of both the public and the foreign air authorities. Up to this time no reason has been given for this action.

Aircraft Bomb Uncertainty

Still another instance of the apparent lack of co-operation is shown in our air bomb construction. The Allies discarded the single fuse bomb two years ago for the bomb with an instantaneous fuse at one end and a time fuse at the other. They also limited the production of the small 20-lb. bombs and increased on the 260-lb. and 500-lb. bombs. Up to a few weeks ago, according to reports here, the American authorities were concentrat-

ing their efforts on a single fuse 20-lb. bomb. Apparently there has been some protest, as it is now said that investigations are being held regarding the advisability of building the larger and two-fuse bombs.

"Too much desire to change," "too many engineers with individual preferences," "too many authorities" and "too little regard for foreign engineering practices" are said to be the principal causes for our airplane failure by those foreign experts who could be induced to express an opinion. They complain that when a type of airplane, such, for example, as the Caproni, is brought to this country, everyone of several hundred engineers has different opinions for changing the design, with the result that much time is wasted and that frequently harmful practices are incorporated.

DeHaviland Changes

Another example is that of the DeHaviland 4 as made in this country and regarding which many officers testified before the Senate Committee telling that it was too dangerous to fly. This machine as made in this country differs so radically from the British machine that it is difficult to realize that it is an adaptation from it. The original DeHaviland 4 is recognized as one of the most efficient airplanes used at the front. In fact, the entire DeHaviland line of airplanes are recognized as being among the best produced. It is said that no DeHaviland has been a failure. Yet our engineers so completely changed the DeHaviland 4 that it is reported to be a failure in this country. It is said that they have reduced its efficiency 66 2/3 per cent by adding unnecessary structural and material equipment.

The testimony of the witnesses as made public by the Senate Military Affairs Committee, including more than 1200 pages of statements, shows that an ambitious program is still contemplated and considered possible for the coming year.

Opinions of Aircraft Experts from Senate Report

Kenly Tells of Conflicting Cables from Pershing — Ryan Praises Liberty Engine — DeHaviland 4 Plane Not Yet Satisfactory — Henry Ford Advocates Single Head for Airplane Work — Nash Believes We Cannot Deliver 10,000 Planes by July, 1919 — Edgar Wants More Training Fields — Caproni Contract Delays

THE variety of impressions in the 1226 pages covering the investigation of the Sub-committee of the Committee on Military Affairs, United States Senate, indicates how even to-day this stupendous maze of aircraft necessity has not sufficiently crystallized itself so that a definite program can even to-day be outlined. The following brief extracts from the examination of a few of the 100 or more witnesses serves to indicate this.

Major General Kenly, in his statements, told that the program calls for 350 complete squadrons during the coming year. This means between 6000 and 8000 airplanes. The pilots are already being trained. More than 3000 are ready. General Kenly told the committee that at this time there are thirteen American air

squadrons in France, comprising 273 airplanes. He said that there should be 175 squadrons with approximately 3500 airplanes with the American Expeditionary Forces.

General Kenly told that General Pershing frequently sent a cablegram ordering one type of plane one day and another countermanding it the day following. He stated also that while there was no friction between the Army and the Navy, there is a strong feeling on the part of the Army that the Navy is getting more than its share. He testified that General Pershing countermanded the order for Spad production last year and confirmed the recent rumors that criticism had come from General Pershing of the DeHaviland airplanes shipped to him.

John D. Ryan, chairman of the Department of Aircraft Production, and General Kenly both approved of the centralization of aeronautical activities under one head. Stories of what they called waste of millions of dollars were told and General Kenly laid the responsibility for the early delays and failures to lack of proper organization and executive ability. The DeHaviland 4, said the general, is not yet satisfactory, but is being perfected and is likely to be successful. The DeHaviland 9, he said, will soon be in quantity production.

Mr. Ryan testified that the Liberty engine, both eight cylinder and twelve, is rapidly reaching perfection and will be widely used. General Kenly also praised the engine, but complained that the original aircraft authorities should have developed an individual airplane for the Liberty engine and used foreign airplanes temporarily, earlier in the war.

Mr. Ryan stated that Colonel Deeds of the Signal Corps and Colonel Montgomery, both of whom had been criticized in the committee's report had practically severed their connections with the Department of Aircraft Production. He said that when he took charge of this department none of the men at the head of it were experienced so far as he knew. He told that loss of time and lives and waste of millions of dollars was the result of their work. We have not built a single fighting plane up to this time, he said, because we have wasted time experimenting with a machine to fit the Liberty 12 cylinder engine. The changes ordered in the DeHaviland plane by General Pershing, he said, will make it more serviceable, useful and of greater military value. He predicted quantity production of the DeHaviland 9 by October. The Liberty engine, he said, is better than any engine on either side of the water. There will be ample spruce for airplanes according to Mr. Ryan.

W. C. Potter, who was in charge of equipment under the Signal Corps and who is now Assistant Director of Airplane Production, told that General Pershing has asked for 25,000 airplanes by July, 1919. He stated that it is possible that 18,000 or 20,000 might be delivered.

Ford Production 100 Daily

Henry Ford told the committee that the Liberty engine was the best airplane engine that has ever been designed and that his factory would produce 100 of these engines daily in the near future. He advocated a single head to control airplane engineering, production and operation.

Charles W. Nash, president of the Nash Motor Co., and now a member of the Department of Aircraft Production in charge of engineering and production, stated that DeHaviland airplanes only could be delivered by January. He believes that delivery of 10,000 air planes by next July would be nothing short of miraculous.

The training of aviators and the surplus of pilots now awaiting airplanes was described by Colonel C. G. Edgar, who was construction head of the Signal Corps. Colonel Edgar urged the building of more training fields and stated that those now in use are seriously overcrowded. He told, for example, of Camp Kelly No. 2 at San Antonio, Texas, originally built for 2100 men and now housing 4700.

Examination of officers of the Standard Aircraft Corp. developed the fact that this company's organization was reduced by 60 per cent due to the absence of Government work. The senators spent much time with the officers of this company in questions relating to its financing.

Captain Ugo D'Annunzio of the Italian Aviation Service and formerly chief engineer of the Caproni plane,

told how he had been disappointed in finding no manufacturing facilities for the Caproni machine and how he had been led to believe that these facilities existed by various officers and manufacturers. He praised the Liberty engine. He told that he had urged the officials to give the Standard Aircraft Corp. an order for two or three hundred Caproni machines because they had already translated the drawings according to their own factory facilities and stated that this suggestion was ignored. Other Italian officials testified that practically daily the American Government aircraft authorities would change their mind regarding the production of Capronis, decided one day to build 1000 and countermanding the order the next day, deciding to change certain details of construction one day and again deciding differently the following.

Much additional testimony of this same nature showing conflicting orders and indecision was added by various manufacturers. Weaknesses of airplanes and dangerous construction was described by fliers who testified.

Uncertainty Still Exists in Aircraft Program on Planes

(Continued from page 356)

garding the industry's having acted in a grasping manner toward the airplane orders.

All of the statements regarding the past do not affect the matter in hand, which is winning the war, so much as the fact that the factories now stand ready to go ahead and yet cannot get releases in sufficient quantities to keep the plants going to full capacity. Where the delay comes in, would have been a part of the report. For instance, the contract for 3000 Hispano-Suiza engines was presented by the army and cleared through the Aircraft Production Board in November, 1917. It is only within the past few weeks that "Go ahead" orders were given manufacturers on these engines. In the mean time what became of the orders? Why and where was the delay?

If anyone were to place a finger on the place where the delays have occurred it would be found to be nearly always where foreign practice entered in. The navy has gone ahead with its schedule remarkably well. It has never paid any great amount of attention to foreign development, but has followed American development straight through. It has never been possible to get foreign drawings that American shops could use. It has always been necessary to tear down the machine and measure it to make drawings that we could employ.

When all has been said, the original program of taking what we could of foreign production, but of going ahead on our own engine, the Liberty, has proven to be best. It was originally intended to make the Liberty engine in four, six, eight and twelve cylinders. We gave up all but the twelve and have now come back to the eight. Perhaps we shall return to the four and the six. This gave a range of engines that would cover every field in spite of the fact that the Senate committee points out that we have "made a mistake in trying to build an engine suitable to all purposes."

We have got to win the war. That is the final test and we need not be afraid that this country is going to fall down on its airplane program. The industry awaits the Hughes report with the feeling that it will clear up through its accuracy the vague accusations in the Senate report. In the meantime production is going ahead, and with the release of pending orders will unleash in full the productive ability of our plants. Ford is now turning out over

twenty-five Liberty engines per day, and so also are Cadillac and Lincoln Motors. The General Motors Co., in spite of the impression created by a conversation quoted in the Senate report, is doing its utmost and will soon be up to a production of fifteen per day. Perfection has not been reached, but every day irons out difficulties which appeared overwhelming a few months ago, and every day brings smoother operation of the machinery.

Coffin Protests to Congress

Declares Civilian Men on Aircraft Production Board Were Advisory Only and Had No Executive Powers of Any Kind—Executive Power Was Vested in Army and Navy Representatives on Board Who Determined Program

LETTERS of protest by Howard E. Coffin, former chairman of the Aircraft Production Board, were read into the Congressional Record following presentation to the Senate of the Military Affairs Committee report.

Mr. Coffin protested that neither he nor his board

had at any time any executive authority and had only been clothed with advisory powers. He stated that all contracts had been made by the various bureaus of the War and Navy Departments and that the Aircraft Board never exercised jurisdiction in these lines.

Following are the letters of protest in full:

Hon. Charles S. Thomas,
United States Senate,
Washington, D. C.

My Dear Senator: I am in receipt of copies of Judge Garrison's communication to you under date of July 26 and of your reply thereto under date of July 27.

The misleading publicity referred to by Judge Garrison continues to emanate from Washington at regular intervals, and has its inception in the fact that neither in the press nor in the public mind has there ever been a proper understanding of the status of the Aircraft Board or of its non-executive relation to the War and Navy departments. Even in Washington, except in the minds of those having special knowledge of the facts, there has been a tendency to ascribe to the Aircraft Board executive and administrative powers similar to those of the Shipping Board or its Emergency Fleet Corporation and capabilities of action independent of the War and Navy departments.

Much of this confusion of mind has arisen from the fact that three Army officers appointed by the Secretary of War to membership on the board and the three naval representatives appointed by the Secretary of the Navy have served in the dual capacity, namely, in an advisory and entirely non-executive role when sitting with the board, but as executive officers having full power when functioning in their capacity as bureau heads of the War and Navy departments.

I trust that, in simple justice to Mr. Howe, Mr. Thayer and myself, as the civilian members of the Aircraft Board, vested with no executive powers of any kind, and dependent for all information concerning and contact with the technical and administrative phases of the Army and Navy aircraft programs upon the duly constituted representatives and

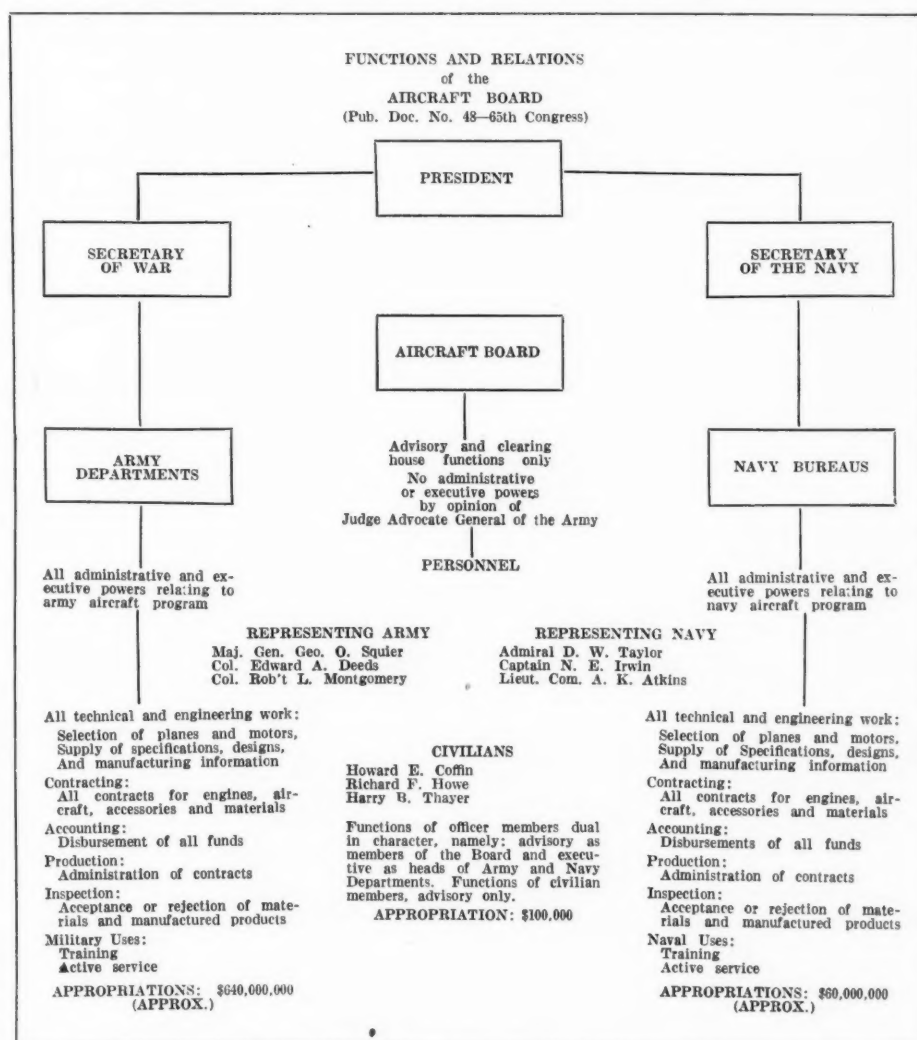


Chart to which Mr. Coffin refers and which shows the organization and personnel of the Aircraft Board

channels of these governmental departments, such a clean-cut distinction and statement of fact may be incorporated in your report as will place before the American people the true status and relations of the three organizations involved in the governmental aircraft program.

For your reference I am enclosing you herewith a chart wherein these relations are clearly set forth in accordance with the rulings of counsel of the Aircraft Board, of the office of the Judge Advocate General of the Army, and the Secretaries of War and of the Navy.

The relations of the three civilian members of the Aircraft Board and of the board itself have been exactly the same to the Navy Department as to the Army, and neither the successes nor the failures of either of these departments in technical or administrative lines can be ascribed to the civilian members of the board.

All decisions as to types of planes and engines put into production have been made by the technical organizations of the War and Navy departments, and all resolutions relating to the placing of contracts have originated within these departments before being brought before the Aircraft Board for clearance.

It has been only within these governmental departments that there has existed a sufficient knowledge as to the requirements of the air services to permit the origination of decisions and actions of this kind. Certainly Howe, Thayer and myself, as the three civilian members, did not dictate in any way in such matters.

All contracts for aircraft have been made by the duly qualified bureaus of the War and Navy departments, and the details of these contracts negotiated by the executive officers of these departments. The administration of all aircraft contracts has from the beginning lain entirely within the hands of the departments and bureaus of the Army and Navy services, and neither the civilian members of the Aircraft Board nor the board as such has ever exercised jurisdiction in these lines. It is significant in this connection that the Navy program, bearing the same relation to the Aircraft Board and its civilian members as that of the Army, and using the same forms of contract, has gone ahead and at high speed, while that of the Army has been and is still in difficulties.

Quoting from the fifth paragraph of your letter addressed to Judge Garrison, you state "that he was before the committee last January or February for something over two days, and if the program which he discussed at the time had been 10 per cent as well advanced as he then assured us it was the present investigations would have been unnecessary."

Permit me to point out to you:

1. That in these two days' hearing the subject of aviation was discussed only for a considerable portion of the first day, and that a part of the first day and the whole of the second was given over to a discussion of the general industries situation in the conduct of the war.

See page 2253 "Investigation of the

War Department Hearings before the Committee on Military Affairs of the United States Senate, Sixty-fifth Congress, Part 6, January 30 to February 2, 1918."

2. That all information given by me to the Senate committee, that portion of the first day's hearing devoted to aircraft, was, of necessity, furnished to me through the War and Navy department channels having responsibility for aircraft production, that this information was exactly the same as that being supplied by the Signal Corps of the Army to the Secretary of War and that War Department officers having the confidential military and production aircraft programs in their charge were assigned for attendance in the Senate committee rooms during my hearing in order that these reports and records might be available for reference.

3. Under the restriction of the bill creating the Aircraft Board limiting its activities to those of a non-executive nature and prohibiting the building up of any office or organization parallel or duplicating the activities of the executive bureaus of the War and Navy departments, it should be clear that the civilian members of the board were dependent entirely upon the official representatives of those executive departments for reports as to military or naval plans and progress of production. I believe it has never been within the power of the three civilian members of the board, even had the necessity been recognized, to institute a thorough-going investigation as to the truth or falsity of these War and Navy department reports made to the Board and supplied to the chairman of the board for use in the Senate committee hearing. It has seemingly required months of investigation, backed by full executive power, to enable either the Senate committee or the Judge Hughes managerial difficulties of the War Department in the carrying out of its aircraft program. It should be evident, therefore, that the civilian members of the Aircraft Board could scarcely have inaugurated an investigation of the business management and progress of the War and Navy departments' administrative bureaus, particularly in view of the fact that at the time of the Senate committee hearing of February 1 there was no realization of the necessity for such investigations.

4. In view of the figures, schedules and reports furnished by the War Department at the time of the Senate hearing, I believe my testimony before this body to have been most conservative. Permit me to call to your attention your own question addressed to Gen. Squier, to be found at the bottom of page 2134 of the Senate hearings; also to the question of Senator Wadsworth, addressed to Col. Deeds, middle of page 2153; also to statement by Chairman Chamberlain, middle of page 2157. These references indicate clearly that my statement before the committee has not been a glowing or unduly optimistic one. In my first day's hearing before you I did point out to your committee the peculiar non-executive and purely advisory relation in

which the board stood to the Army and Navy services under the creating act of October 1. I also transmitted to your committee the information furnished by the Signal Corps that it was expected that 1900 planes would have been shipped for overseas service prior to July 1. Permit me also to call to your attention the contents of the four paragraphs on page 2209 of the Senate hearing, comprising Col. Deeds' description of the manner in which the War and Navy departments' decisions as to types of planes and engines were arrived at, the method of placing contracts and the advisory or clearing-house relation of the Aircraft Board to these contractual activities.

In connection with the Senate hearing I distinctly remember stating to the committee that inasmuch as the relations of the civilian members of the board to the Army and Navy programs were indirect, it would be necessary for the committee to obtain any detailed information it might desire from the War Department officers having executive charge of the work. I believe that several such officers were subsequently called before the committee and military and production information furnished in answer to inquiries of the members of the Senate committee.

In leaving this subject of the Senate hearing in January, permit me to say that I do not believe that you or any other member of Mr. Chamberlain's committee believes that I in any way purposely misled you as to the situation. I transmitted to you gentlemen War Department information which was being embodied in reports both to the Aircraft Board and to the Secretary of War, and frankly resent any inference suggesting deception. In the records of the Aircraft Board for December and January will be found reports made to the board by the War Department representatives as to production progress. At one of the January meeting just prior to the Senate hearing the Secretary of War was himself in attendance when production reports were presented by the Signal Corps.

My statements in these matters can, should you so desire, be verified by referring them to Mr. Richard F. Howe of the International Harvester Co., the civilian member appointed to membership upon the board by President Wilson in November. Mr. Howe is now in Washington and can be reached care the Aircraft Board, of which he still remains a member.—H. E. COFFIN.

Detroit, Mich., Aug. 16, 1918.

Hon. C. S. Thomas,
United States Senate,
Washington, D. C.

In connection with your report as chairman of the Senate aircraft committee, may I not ask that in fairness to Messrs. Howe, Thayer and myself, as the three civilian members of the Aircraft Board, having no executive relation to the engineering, contracting, accounting, production or inspection work of the departments, you will give careful consid-

(Continued on page 391)

[Complete Text of Aircraft Report appears on page 393.]

Benz Now Uses Aluminum Pistons

Weight of Piston Reduced 27 Per Cent and Compression Ratio Slightly Increased—Very Narrow Compression Rings a Feature

THE original Benz aircraft engines of 160 and 230 hp. had light cast iron pistons in which the piston head was slightly domed and reinforced by a perforated steel cone riveted to the head and resting with its apex on the piston pin. In February last an Aviatik biplane with 230-hp. Benz engine was brought down in which were found aluminum pistons. As these are the first aluminum pistons ever found in enemy aircraft and as they are probably the largest diameter aluminum pistons ever successfully used, details of their design and of the composition of the alloy employed should be of interest. This information has been given out by the Technical Department, Aircraft Production, British Ministry of Munitions.

Piston Weight Reduced One-Third

The pistons weigh 4.53 lb. each without rings, which weigh 0.095 lb. each. The total weight of the complete piston, with rings and gudgeon pin set screw, is 4.91 lb., as compared with the standard cast-iron piston, which weighs 6.72 lb. The piston pins and connecting rods are of standard Benz design, as also is the rest of the engine to which these pistons were fitted. The design of the standard cast-iron Benz piston, which is fitted with a conical steel support, riveted to the inside of the piston crown, and which bears upon the center portion of the gudgeon pin through a slot cut in the connecting rod small end, is well known. Unlike the standard cast-iron piston, the domed head of the sand-cast aluminum piston is supported and strengthened by eight webs radiating from a central boss in the piston crown.

The formation and shape of the webs are clearly shown in the sectional drawings. Three cast-iron rings are fitted above the piston pin, and one scraper ring is provided below the gudgeon pin. All rings are concentric and are machine hammered on the inside. It will be noticed that the rings are all exceptionally deep in section, being 0.21 in. deep and only 0.12 in. wide vertically. The piston ring gap measured in position in a standard 230-hp. cylinder was found to be exceptionally wide, i.e., 0.076 in. As may be seen in Fig. 2, the piston pin bosses are fitted with steel bushes 0.080 in. thick. These are cast into the bosses in the usual way. The piston pins are 1.50 in. diameter, and the piston pin bosses are 2.55 in. diameter. The method of fixing the piston pin by a hexagon-headed set screw and split pin is standard Benz practice.

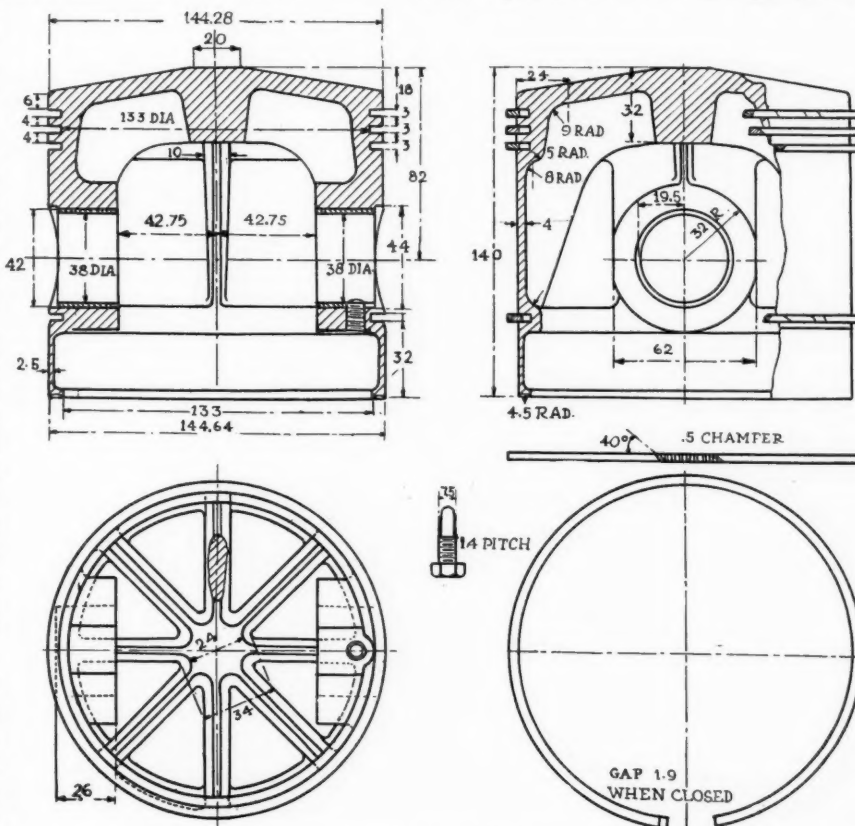
An annular semicircular groove 0.197 in. radius is machined on the bottom lip of the piston, as shown in the section drawing, and the inside of the skirt is machined inside up as far as the reinforcing rib of the scraper ring directly below the piston pin.

Further details of the design of these aluminum pistons are shown in the illustrations, and the chemical composition of the alloy from a metallurgical analysis carried out at R.A.E. is as follows: Copper, per cent, 6.02; zinc, per cent, 12.13; iron, per cent, 1.42; silicon, 0.31; tin, nil; nickel, nil; manganese, trace; magnesium, trace.

As the engine from which these pistons were taken was found to be too badly damaged to carry out a test, it has been impossible to ascertain the increased relative efficiency between this engine and the standard 230-hp. Benz. The compression ratio, however, is apparently slightly higher in the engines fitted with the aluminum pistons, and the distance between the top of the piston and the central axis of the piston pin is increased from 2.750 to 2.785 in., which gives approximately 1 cu. in. less clearance volume, making the compression ratio 5 to 1 instead of 4.94 to 1.

The clearance allowance corresponds to 0.005 in. per inch of bore at the head end and 0.0025 in. per inch of bore at the skirt.

A NEW Danish process by which certain by-products, valuable for electrical insulation, may be made out of fish offal, is soon to be put to practical test in Skagen, Denmark, according to the United States Commerce Reports. The most important of the new products is called "cornimit," and a factory known by that name is now being erected. It is claimed for "cornimit" that it excels galalith as an insulating material.



Sectional views of piston and details of piston pin screw and ring

Intensive Training in An Aircraft Plant



Learning to assemble wing floats

NOT long ago the man had to steal his trade. Yesterday the trade stole the man. To-day industry is filling its needs for skilled operatives by training the unskilled. And now the shortage of skilled labor has been followed by a shortage of men which will constantly increase as the army and navy grow.

The Curtiss Aeroplane & Motor Corporation of Buffalo, N. Y., faced the labor shortage problem in a very intensive way during the past winter, and in April last opened a training department which has since developed to such a degree that it can produce upwards of 10,000 operatives a year, trained for production.

Owing to the shortage of men, an experiment was made with women, resulting in the greatest of satisfaction, as shown by the fact that the foremen's requests for help during a recent month showed an increase of nearly 100 per cent for women over the previous month. Many of them now say that properly trained women are much better than the men they were able to get.

As soon as it became evident that something must be done to

Curtiss Company's School
Has Capacity of 200 to 300
Operatives Per Week

Women Develop Skill After
Short Instruction
Period

By Frank L. Glynn*

develop the skilled help needed, the company set aside a good-sized space on a mezzanine floor, approximately 5000 sq. ft., as a central training department. This space was supplemented by adding other suitable spaces in the various productive departments throughout the plant so that a total of more than 10,000 sq. ft. is now used for purposes of instructing unskilled new employees.

It has been found desirable to train operatives in several places in the plant rather than to have all of the training done in one larger central department, as there are some operations which do not lend themselves to the purpose of training when this is attempted outside the regular production department.

To-day the complete training system has a capacity of between 200 and 300 persons per week. The number



Beginners in the "dope" room. Young girls and middle-aged women are among the applicants

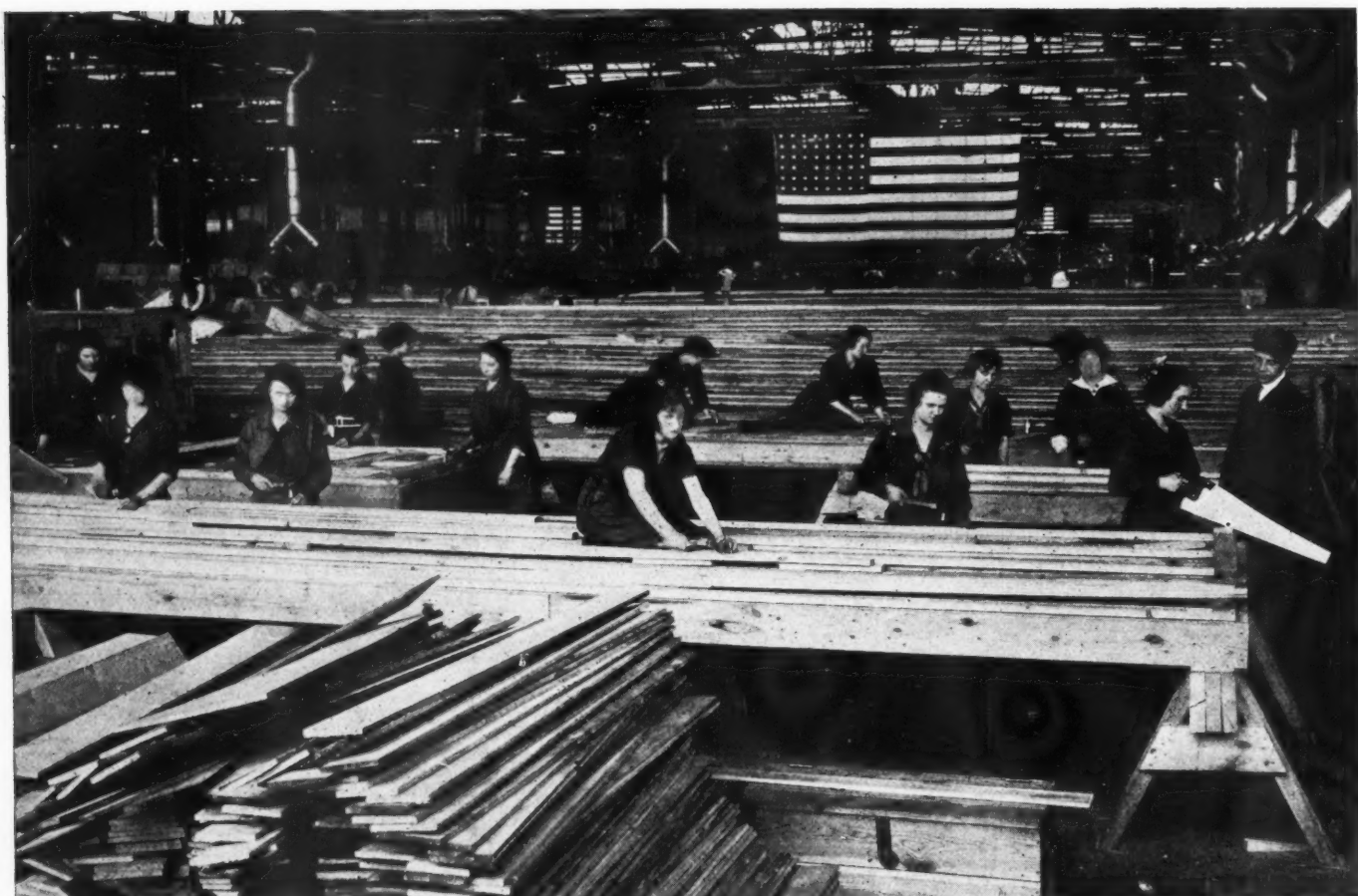
*Director of Production Training, Curtiss Aeroplane & Motor Corporation.



Learning the intricacies of wing assembly under the watchful eye of the male instructor. Fully 98 per cent of the women who have entered the employ of the Curtiss company had no mechanical experience



Female instructors teach beginners the various operations of the sewing department. By intensive methods the learning period has been reduced to an average of about two weeks



Women are taught and employed for even some of the heavier operations in the shipping department. A number of girls are here being shown how to crate wings

trained each week has been constantly increasing from a relatively small beginning. The actual average per week of new employees trained during a period of four months is 87.

As to the cost of training, it can be said, as can of course be said of all such training systems, that the actual cost must be considered to be the difference between the cost of production in the training department and in the regular production department, and in calculating this cost the additional overhead in the form of instructors' salaries, spoilage, etc., must be taken into account.

In the Curtiss plant it has been found that the average gross cost of training has been approximately \$35 per individual, and the net cost, figured as above indicated, averages between \$7 and \$9 per employee.

Instructors have been developed from those already in the company's employ as mechanics or operatives and by taking shop instructors from schools and giving them actual production experience in the department of the factory for which they are to train help.

At first there was considerable objection to introducing women operators, as aircraft work requires a high degree of skill, and the consensus of opinion was that "women don't know anything." Without question, fully 98 per cent of the women who have entered the Curtiss employ never had any previous mechanical experience, yet the number of unsuccessful ones out of the thousand promoted from the training department during the past three months was negligible. The elimination came during the training period, which averaged about two weeks' time. During these two weeks, however, many were saved who otherwise would have been failures, because the training work not only taught them the various operations, but also fitted them into the special work for which

they were adapted, thus reducing the turnover materially.

The actual work may be carried on anywhere, but the organization and operation of the training department must be segregated and its departmental relations must be carefully planned or it will cause as much trouble as the "youngest in the family" usually does.

This, however, is a matter of detail in the original layout for the introduction of the training work and varies greatly with the individual plant or type of factory organization. After the work is successfully begun, it is comparatively a very simple matter for any factory to maintain it through the usual factory force.

If the original plan of organization be right, the training department will turn over with such rapidity that the cost should be reduced at least 50 per cent over what it otherwise might be; just the same as in the production of materials. This means one-half the floor space, one-half the equipment, one-half the instructive force and one-half the wage cost for the learning period. Then, too, the matter of properly intensifying the "learning period" to reduce it to the shortest possible minimum is exceedingly important in this respect and depends entirely on the original layout of the plan for operating.

The Curtiss work was the pioneer effort in the United States for the training of a large number of operatives daily in a short period of time. Green people were taken in and trained in an average of two weeks' time where the old shop practice would have taken at least six weeks with but little assurance of success.

Thus the training department in the Curtiss plant has been a saving to the company and the Government instead of a disbursement, besides which it assures the placing of employees in the proper place for highest pro-

duction and personal satisfaction.

Actual production orders are taken for the training work and no practice work or imitation miniature articles are built, and all work is done on a time-study basis. The people are trained on the real article and the real machine, so that when turned over to the production department they can give real service.

The result has been that the labor needs of the factory can readily be recruited, production carried on to better advantage during the learning period, the turn-over decreased, and the foremen are much more highly pleased at receiving the trained worker, made to order, than having to deal daily with green help.

We do not feel that we have solved the problem for all factories, nor do we feel that this is a panacea for all the labor ills, but for the Curtiss company the training department has rendered a large service in production training from fitting a girl to use a hammer and saw, milling machine, weld or braze, all along the line even to training for inspection.

Each factory is a problem in itself, depending upon its particular type, method and volume of production, and the numbers employed, so that this article is presented



Propeller finishing is another of the operations which the Curtiss company now has done by women. These beginners will soon be put into the regular production department

more as a suggestion of possibilities rather than as full information for any one to use as a patent medicine to cure all the ills that flesh is heir to.

New Foot Warmer for Aviators

AN electric foot warmer for the use of aviators, truck drivers, etc. has been invented by W. W. Lillard, 274 Monticello Avenue, Jersey City, N. J. Mr. Lillard, an electrical engineer, is at present on active service, and the invention is being promoted by Ernest J. King, of the same address.

The equipment comprises an insole of the same general appearance as the common slip insole, except that it has two plugs at the heel, which project about one-eighth inch from the bottom. These plugs are the terminals for the resistance wires or heating unit which is imbedded in the insole. When the insole is placed in the shoe the plugs fit snugly in two small sockets which are sunk in the heel about one-eighth inch.

There are two different ways for conducting current to the contact sockets in the heel. One consists in having two narrow metal strips extend along the outside of the sole from the heel for the distance of about an inch, these strips being adapted to make contact with contact plates in the foot board. The other method consists in bringing two very thin wires down the back of the shoe inside the back stay to the contact sockets, connection being made at the top of the shoe through two small snap-fasteners which are barely visible. A thin wire is fastened to the inside seam of each trouser leg, extending to the waist, where connection may be made with the electrical source. In making connection in this way there is absolutely no wire to get in a person's way.

It is claimed that a person equipped with this device may keep his feet as warm as he wants to, and that when his feet are warm his whole body is warm. The heating element is intended to be operated from a 6-volt battery, and as each heating element has a resistance of about 6 ohms, the current consumption is only one ampere.

Exhibition of New British Products

THE British Science Guild has organized a comprehensive exhibition of products and appliances of scientific and industrial interest which, prior to the war, were obtained chiefly from enemy countries, but are now produced in the United Kingdom. The exhibition, which is being held at King's College during August and the first week in September, contains, in the first place, products chiefly imported from Germany before the war, but now made in England, but it also illustrates the remarkable developments that have taken place generally in British scientific industries during the past few years.



Screw machines are operated almost exclusively by women in the Curtiss plant. They were all trained in the company's school

The Peoria Kerosene Tractor

Assembled of Parts Produced in Specialized Plants—Engine, Clutch and Transmission Bolted Together—Drawbar Hitch Can Be Laterally Adjusted from Driver's Seat

A TRACTOR of 12-25 hp. rating made largely of parts of specialized manufacture is produced by the Peoria Tractor Corp., Peoria, Ill. The current product is referred to as Model J and is equipped with a Climax kerosene engine of 5 in. bore by 6½ in. stroke (510.4 cu. in.). The clutch is a Borg & Beck and the transmission a Nuttall, so the machine is composed mainly of well-known parts.

The frame is built up of 6-in. heavy channels which are tied together by three ½ x 6 in. steel plates, bob riveted. To the forward end of the frame is riveted a front axle pedestal, made of ½ x 6 in. steel plate. This pedestal extends from side to side of frame, but is stiffened by props at the center. An unusual design of front axle is used. It is certainly somewhat crude looking and emphasizes the need for specialized tractor axle manufacture which has been advocated in these pages. The main element of the axle appears to be a length of Tee iron, to the top flange of which are riveted two suitably bent pieces of strip iron to form the steering yokes. These steering yokes extend about half way to the center of the axle and are made so long to permit of the steering arm on one of the knuckles, to which the drag link is connected, to swing through it. At the center a swivel bracket is bolted to the axle, to which connects a swivel post through which the weight of the frame is carried on the axle. A coiled spring supports the frame on the vertical post. The details of construction of this spring mounting unfortunately cannot be clearly made out from the illustration. To take up any lateral thrusts on the axle two radius rods are run from it to a frame cross member back of the engine. The two steering knuckles are identical in design and therefore are interchangeable. The front wheel spindles are made of cold-rolled stock and are secured into the knuckles by means of nuts. The arms for the tie rod are formed integral with the knuckles but the arm for the drag link is bolted on.

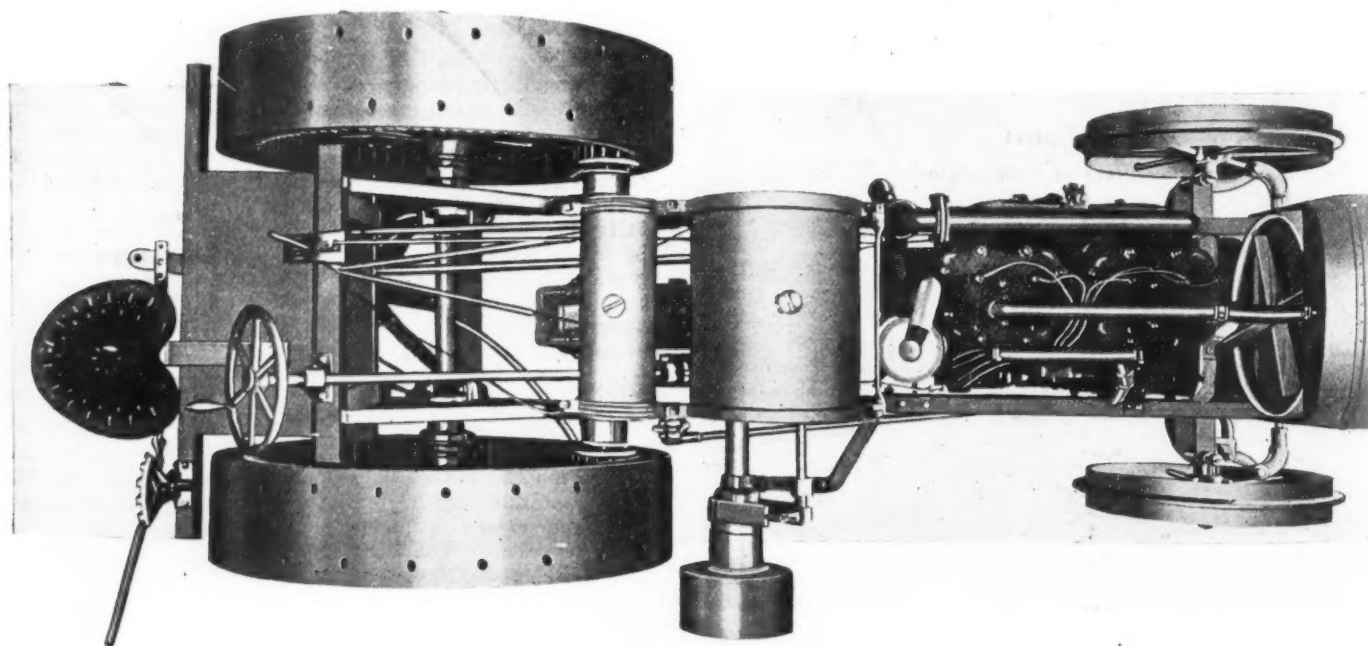
It is not necessary to say much about the engine, as this has been fully described in a previous issue of *AUTOMOTIVE INDUSTRIES*. It may be recalled that it is a four-cylinder machine of 5 in. bore by 6½ in. stroke (510.4 cu. in. displacement) and is designed to operate at 650-800 r.p.m. The power rating is 34 hp. An enclosed governor is fitted and the cylinder heads are detachable. The engine is specially designed for operating on kerosene, there being a deep water space above the combustion chamber and the spark plug bosses in the cylinder head being completely surrounded by water.

A 1½-in. float feed type of carbureter is used, specially adapted for working on kerosene, and ignition is by an Eisemann magneto with impulse starter. Magneto, governor and water pump are located in line at the side of the engine and driven through the same gear train. The engine is supported by four arms cast on the crankcase and bell housing, directly on the main frame. The radiator is a Eureka with copper tanks and the radiator fan an Oakes mounted on ball bearings and driven by a 2-in. flat belt. The air taken in by the carbureter is drawn through a Bennett air cleaner.

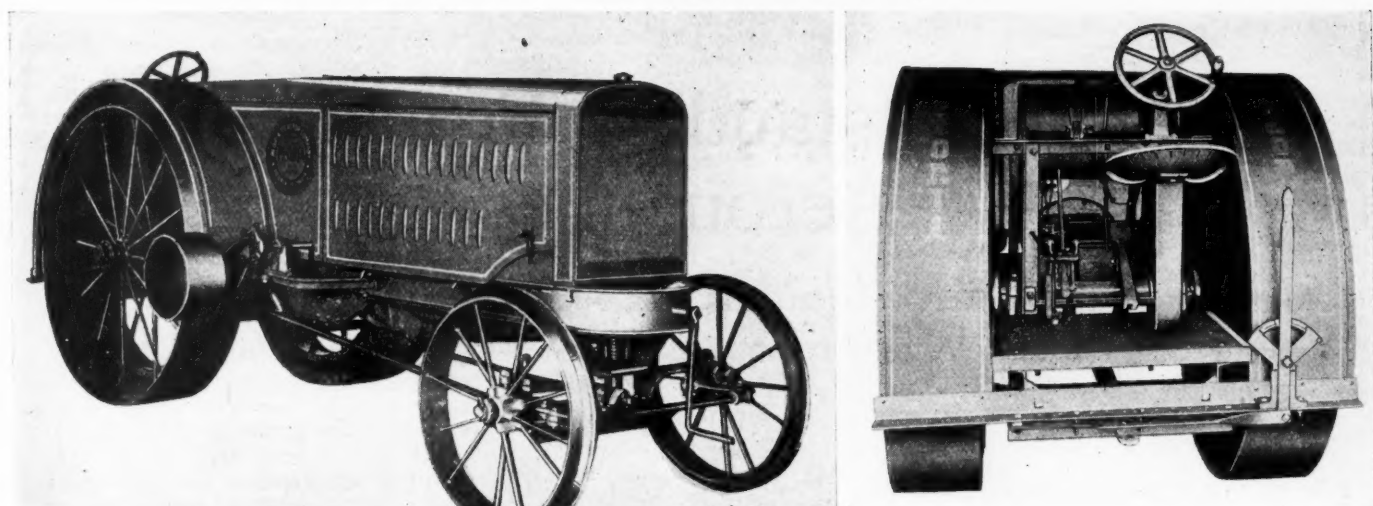
Fuel is carried in two cylindrical tanks resting on top of the frame back of the engine space. The kerosene tank, which is closest to the engine, has a capacity of 22 gal. and the gasoline tank 5 gal.

Unit Power Plant Construction

As already pointed out, a Borg & Beck plate clutch is used, this being a special tractor design and having its front end supported on a ball bearing. Directly back of the clutch is the Nuttall transmission, which affords two forward speeds and one reverse. This transmission, which is enclosed in a cast-iron case, comprises not only the change gears but also the jackshaft and differential, as well as a belt power take-off shaft. All gears are made of medium carbon steel, and



Plan view of Peoria tractor with hood removed



Three-quarter front view and rear view of tractor

after the teeth are cut the gears are hardened and ground. The shafts are of forged steel, hardened and ground. They are mounted in Hyatt roller bearings. The case is partly filled with oil and is provided with a very large cover plate admitting of easy access to the gears, bearings, etc. Shifting of gears is effected on the selective principle and a lock is provided which makes it impossible to engage two sets of gears at the same time. The two forward speeds are $2\frac{1}{2}$ and 4 m.p.h. respectively.

A power take-off shaft extends from the gear case over the top of the side frame and carries a brake pulley and a belt pulley. The belt pulley is 14 in. in diameter, with a 7-in. face, and at 800 r.p.m. of the engine gives a belt speed of 2400 ft. per min., the gearing being such as to give 650 r.p.m. of the pulley shaft at 800 r.p.m. of the engine crankshaft. It will be seen that the belt pulley extends beyond the rear wheel, which has the advantage that the belt can be run either to the front or rear. The long overhang of the belt shaft tube detracts somewhat from this advantage, however. The brake drum is of very small diameter and the way the brake contracting gear is designed it must impose very considerable pressure on the outboard bearing of the pulley shaft when the brake is applied. The brake is controlled by the same pedal as the clutch, the first motion of the pedal releasing the clutch and continued motion applying the brake, which latter is faced with Non-Burn friction lining.

Final drive to the rear wheels is by internal gears. The pinions for the final drive are secured to the ends of the jackshaft forming part of the Nuttall transmission. There are pads formed on the jackshaft tubes by which the transmission is supported on top of the main frames.

Rear Axle of Cold-Rolled Stock

The rear axle consists of a cold-rolled steel bar $2\frac{15}{16}$ in. in diameter and 64 in. long. It is fastened to the frame by means of two adjustable axle brackets. By means of these brackets the driving pinions can be brought into accurate mesh with the internal gear bull rings on the rear wheels. A further advantage claimed for this axle construction is that when the axle spindles in the wheel hubs have worn on one side, the axle brackets can be loosened up on the axle and the latter turned half way around. Whether this would materially improve the running conditions is to be doubted, however. It will be seen that the internal gears are very large in diameter, not much less than the diameter of the wheels. This permits of the use of relatively large pinions and cuts down the tooth pressure—a desirable feature where the gears are not enclosed.

Driving wheels are 56 in. in diameter and have a rim 12 in. wide. They are of the all-steel type, the spokes being riveted into both hub and rim. A noteworthy feature is a removable cast-iron bearing sleeve 14 in. long. Most of the wear of the axle bearing undoubtedly comes on this sleeve, which can be renewed when the play becomes excessive.

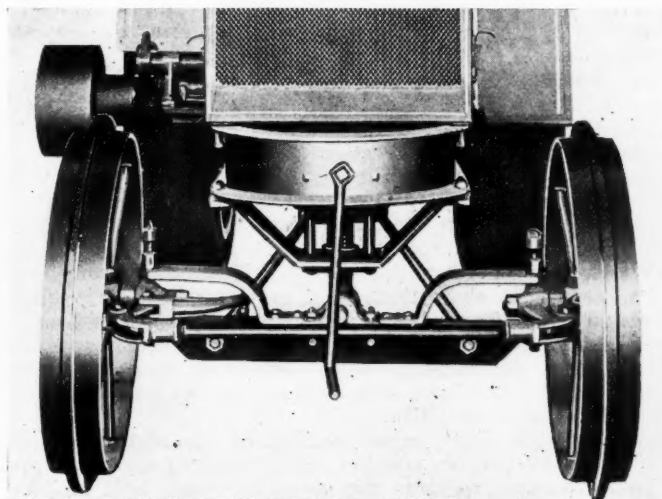
The drawbar is hinged to the frame at its forward end and its rear end has a range of lateral motion of 20 in. This motion is controlled by a lever conveniently located at the side of the driver's seat, enabling the driver to shift the hitch while the tractor is in motion. This feature is of value particularly in side-hill plowing, when there is a tendency for the plows to change the width of the furrow, which tendency can be corrected by means of the hitch lever.

A drawbar plate $5\frac{1}{2}$ in. wide is located directly under the rear axle and is riveted to the frame. The rear axle is secured to this plate by $\frac{3}{4}$ -in. U bolts. The drawbar is 18 in. high from the ground.

The front wheels are 30 in. in diameter and are provided with guide rings. It will be observed that the rear wheels are shown without lugs, and evidently no lugs are included in the regular equipment, though the wheel rims are punched for lugs.

Steering is effected by means of an enclosed worm and gear mechanism of the Peoria company's own design. The steering gear is operated by means of a hand wheel with handle and the steering post is supported at its upper end by a bracket bolted to an angle iron structure secured to the frame. On the rear end of the frame is a wooden floor on which are mounted the driver's seat and the gear control bracket. The combined clutch and brake pedal is directly in front of the driver's seat, which latter is of the ordinary plow type.

The Peoria tractor has a wheel base of 96 in. and weighs approximately 4900 lb. As its drawbar rating is 12 hp. it should develop a drawbar pull of 1800 lb. The belt power rating is 25 hp.



Front view, showing front axle construction and front spring support

Some Outstanding Problems in Aeronautics*

Material for the Different Elements of a Plane—Problem of Size Limits—Variable Wing Area and Camber—Aircraft Engines

By Dr. W. F. Durand

PERHAPS nowhere is there to be found a better illustration of the interdependence of technical and scientific research and study than in the manifold advances in various technical and scientific lines which conjointly have made the aeroplane in its present form a structural possibility.

Broadly, the modern aeroplane comprises a body of some sort or form fitted with wings to provide the supporting surfaces, with a prime mover or source of power and with a propeller of some type to transform the power provided by the prime mover into propulsive work, and by the reaction of the relative air stream on the under side of the wings, to secure the sustaining or lifting force necessary to carry the weight. This construction calls for a wide range of constructive materials. Thus the body and wings, comprising the aeroplane proper, require the following fairly distinct classes of structural elements:

(1) Those intended primarily to give form, strength and coherence to the structure. They represent in effect the skeleton or foundation on which the entire function of the aeroplane as such must depend.

(2) Various secondary elements intended to so tie or connect the principal members together as to secure homogeneity of structure as a whole, and mutually responsive action on the part of the different elements comprised under No. 1. The elements here considered are those which, from a purely structural viewpoint, may be classed as struts and ties or tension members, with suitable connections and joint fastenings.

(3) Surface covering for the body and wings. This gives outer form and continuity of surface and provides furthermore the actual surfaces on which the air lifting and supporting forces may act.

Broadly speaking, the fundamental problem in all aeroplane construction is adequate strength or function on minimum weight. In no other form of engineering construction is the necessity for weight saving so rigorous. In a very real sense every ounce of material entering into the structure must be able to show a competent passport. The structural problem of the aeroplane is therefore one of strength in relation to weight. For the main elements comprising the skeleton of the structure, wood has, thus far, held the main place, with metal construction steadily attracting more and more interest and assuming a place of growing importance, at least in the study of new designs.

It is not necessary to our present purpose that we should consider in detail present practice in aeroplane construction. The trend of development since the earliest days of the art has tended to show that wood construction under suitable design and safeguard was able to provide the easiest and on the whole the most satisfactory solution of the many problems and requirements which aeroplane construction presents, and so we have been content, for the most part, with this type of construction.

We may, however, be well assured that no matter how good may be any solution which we may reach of the many problems presented to us in the industrial arts, there are, as a matter of fact, series of better ones only awaiting our patient

study. This is indeed a fundamental truth of which we should never lose sight. We may be, for the moment, satisfied with our solution of a problem in technical industry; we may be able to see nothing better, and yet we may be well assured that, as a simple matter of fact, there is something better. This is a perfectly safe assertion, if only as based on the law of probability of our having, at any given time, reached the final optimum possible combination capable of furnishing a solution of the problem.

Thus, as applied to the problem of constructing the framework of the fuselage of an aeroplane or of combining together wing spars and ribs in such manner as to form a wing skeleton, we may be sure, however satisfactory our present practice may seem and however good it may really be, that in reality it is not the best and that long series of better solutions only await our intelligent and patient study.

In this and in all such problems there are always two fairly distinct though interrelated parts:

(a) What materials are best suited to the purpose in view.

(b) What disposition shall be made of the materials adopted.

Thus, in the case of the fuselage, granting wood material to be adopted, there remains the question as to the very best distribution of such material as between the main longitudinal elements, or longerons, and the intermediate elements; also as to the extent to which reliance may be placed on the outer covering, especially if of ply-wood. What aeroplane designer can feel sure that, even with given materials, he has reached the optimum distribution of function as between the main and secondary elements of the fuselage and of a ply-wood outer covering?

Much less, what aeroplane designer can feel any confidence in having now reached an optimum combination, once we admit the possibility of metal construction, or of some combination of metal and wood, with all the possibilities of the new light metal alloys and of the new alloy steels with their astonishing physical characteristics.

So far as conditioned by the application of the ordinary loading test, static in character, and aside from the possible results of dynamic attack, shock, long continued vibration, etc., we may perhaps frankly admit that the present state of metallurgy is able to supply us with material, either in the way of light aluminum alloys or special steel alloys, which if properly used will enable us to meet all such static tests in an aeroplane construction, and on even terms or better as regards weight compared with wood.

If such is the case, it certainly stands before us as a problem for the near future to pass in review most thoroughly the entire range of constructive materials, metallic as well as wood, and to determine, in the light of the experience which we are so rapidly accumulating during these days of storm and stress in military aeronautics, the combinations of materials which may assure the most efficient service on the minimum of weight.

In connection with this search for new and better materials must go hand in hand search for better modes of combination in the structure—in other words, better structural design. It goes without saying that the best general type of design, in the way of the distribution of materials, forms and proportions of members, etc., will vary with the class of

*Sixth Wilbur Wright lecture read before the Aeronautical Society of Great Britain at London, June 25.

material employed. There must be some optimum design with wood. There will likewise be another and undoubtedly a different optimum design in the case of steel, and again different in the case of aluminum or other alloys. Thus the search for the best final combination is a search for an *optimum optimorum*; for the best possible material and for the best possible design using such material.

What order of saving may be looked for in the near future from any such search it is, of course, idle to predict. Could we, however, approach somewhat closely to the best use of the best combination of materials even now available in the field of engineering construction and without waiting for new and superior materials which the metallurgical art will doubtless be able to furnish, it seems not unreasonable to anticipate the possibility of a marked saving in weight without loss in strength or security.

This then stands out as one of the great problems of aeronautic engineering, that of the best materials and their best use. Much has already been done, but much yet remains, and rich rewards most assuredly await patient and well directed work in this field.

The Problem of Size

One of the most interesting of the problems presented to the aeronautic engineer is that of the limiting size and carrying capacity of aeroplanes. Is there such a limit? If so, what is it? Why is it? And how may it be removed or extended?

In dealing with this problem we come, of necessity, into contact with the laws of similitude of geometrically similar structures. It is well known that under simple modes of loading, geometrically similar structures of wing and fuselage will have similar factors of safety under equal unit loads. But for such structures, if strictly similar geometrically, the weights themselves will increase as the cubes of the similar dimensions, while the areas of wing or supporting surface will only increase as the square, and hence the ratio of weight to area will continuously increase as the linear dimension.

Under these circumstances, it is readily shown that, in accordance with the relation of the factors involved, there will be for any given speed, some size for which the lifting capacity over and above the structure itself will be a maximum and above which the lifting capacity over and above the structure will become less and less with increase in size, gradually reaching zero for some value of the size of the structure. This would mean that at such point the supporting force developed at the speed in question would be just enough to lift the structure itself from the ground, but with no reserve for additional load.

This is, of course, a definite law derived from well known principles of geometry and calculus, and if it were the whole story, it would indeed tend to raise an insuperable bar before continued expansion in size. If such were the case it would mean in effect that increase in lifting capacity could only be reached by the following measures:

(1) Reducing to a minimum the relation of weight of structure to area. That is, general improvement in the program of design and reduction of weight of structure in relation to supporting surface.

(2) Reducing to a minimum the resistance of the plane at the given speed and likewise the relation of weight to horsepower.

(3) Raising to a maximum the relation of lifting force to area, consistent, however, with the decrease of the total propulsive resistance of the plane.

Were we indeed subject, without recourse, to the operation of this law of mechanics and geometry we should be in a sorry state regarding the future development of the aeroplane as regards size and carrying capacity. We should be limited strictly within the bounds of the developments made possible by improvements and advances along the lines as indicated above. But fortunately for the future of aerial navigation, we are not so limited and there seems no reason why, at the present time at least, we should need to anticipate any especial limit as necessarily imposed on aeroplane construction, as regards either size or carrying capacity.

We are able to escape from the consequences of this law by reason of two facts.

(1) It is not necessary that a large element of an aero-

plane, a wing in particular, should be geometrically similar in structural characteristics to a smaller one. For a certain size the structural elements will partake of certain characteristics. As the over-all size increases, these elements may take on new characteristics. Those which had been solid may now become hollow or of lattice or built-up form. The law of geometrical similitude will not hold, and the weight will not necessarily increase in ratio with the cube of the over-all linear dimensions.

(2) It is by no means necessary that a large aeroplane shall be, in its general form, a geometrical copy of a small one. While both will have similar elements, such elements need not be the same in number or arrangement. In fact, one of the most obvious of means for increasing lifting power is to increase the number of the wings or lifting elements. There is no reason, at least structurally, why wings and connecting elements should not be increased in number beyond anything now in use or even considered—increased to a point which would give a size and lifting power great enough to meet any demands which we can now formulate or which the future seems likely to present.

Structurally, therefore, the problem of increased size presents three problems, as follows:

(1) The structural problem of so developing the character of the elements of aeroplane construction such as wing spars, longerons, struts, ribs, etc., that with increase in over-all dimension the weight shall not increase sensibly faster than as the square of such dimension.

(2) The structural problem of combining the larger elements of aeroplane construction such as wings, fuselages, or engine nacelles with their connecting structures, in such manner as to secure, for a given wing area, the minimum weight of secondary structure.

(3) The aerodynamic problem of combining multiple wing elements in such manner as to reduce to a minimum the interference of one with another. This is a problem which opens fascinating possibilities to the student of experimental aerodynamics—a problem on which already some beginnings have been made, but one far from a final or as yet wholly satisfactory solution, and one on which the future development of greatly increased size and carrying capacity seems destined to largely depend.

In short, then, so far as increase in size is concerned, there seems no reason to apprehend any particular limit, or any serious difficulty on the part of the scientist and the engineer in meeting the demands of the future in these respects. The difficulties seem no greater than those which have been overcome in the case of ocean shipping as shown by the continuous development from the early beginnings of the application of engine power to ocean navigation during the first half of the last century down to the mammoth floating structures of the present time; and if we may take any indication from the accelerated rate of progress which has characterized the entire history of aerial navigation, we may feel confident that we shall not have to wait a half or three-quarters of a century for a parallel development in the latter field.

Variable Wing Area or Variable Wing Camber

To mention only one of the many remaining problems which are connected with the design and construction of the aeroplane itself, a word may be said with regard to the problem of variable wing area. Broadly speaking, the ideal aeroplane should be able to change its wing area in accordance with the conditions and circumstances of flight. For ease in getting off the ground at a moderate speed, for ease in landing likewise at a moderate or low speed, there is need of a relatively large area of wing or supporting surface. For the attainment of high speed, reduced wing areas are needed, and are furthermore sufficient for the support of the weight at such high speeds. The supporting force gained by a given form of aeroplane wing depends on the area, the speed and the angle of attack, and there will be some combination best for each set of conditions. To meet these conditions, varying from time to time throughout the course of a flight, a correlative variation in wing area is needed.

To some extent the same ends may be met by changing the camber or curvature and form of the fore and aft section of the wing.

Thus, when the camber or fore and aft curvature is in-

creased, the form will be more suitable for landing at a reduced speed, while with curve flattened and camber reduced, the form will more readily favor the attainment of relatively high speed.

The problem of an adjustable wing, either as to extent of area or camber or both, is a favorite one with students of aeronautics, and we may hope for some measure of useful and practical solution. Thus far, of the many devices and forms proposed, none has so far fully justified itself as an altogether satisfactory and practical solution of the problem.

Motive Power

Passing now to the motive power and its application to the propulsion of the aeroplane, a most interesting and important series of problems challenges our attention. Only the more important can be noted here.

One of the most important of these is that of fuel. What is to be the future fuel for the aeroplane, or for aerial navigation in its wider aspects? How long will our stores of crude petroleum oil from which we now obtain our petrol or essence or gasoline, as it is variously termed, continue to furnish this all-important element in the present program of power development? Doubtless there are large stores of petroleum oils yet undiscovered, but we may safely assume that we are using up a supply in the nature of a bank deposit. We are using our principal, and not living on the interest. So far as we know, nature is not now engaged in making for us petroleum oils, certainly not in any proportion to our rate of expenditure. To such a general program of consumption there is, of course, but one end, ultimate exhaustion.

This is, of course, only one phase of the overshadowing menace which the modern social and industrial world must face some time when our present supply of carbon and hydrocarbon fuels begins to become exhausted, unless indeed we develop or discover in the meantime some other source of energy which will adequately take their place. This is perhaps a question which need not seriously concern the present generation, but when we take a long look ahead—a look, for example, as long as that covered by the development of Europe from the days of the Cæsars or even from the time of, say, Galileo—we may realize with startling emphasis the need of foresight with regard to a source of energy adequate to the world's demands. Various ages have been designated as of stone, bronze, etc. The present might well be designated as that of natural energy. Our entire civilization, in a material sense, rests upon the utilization of sources of natural energy which are not inexhaustible and which are, in fact, becoming exhausted, in some cases, with menacing rapidity. In the meantime we must, and presumably we shall, make some shift to tap efficiently other sources now known, or we may haply discover sources which to-day lie beyond our present vision.

Fuel Problems

A long look ahead for aerial navigation therefore shows that if the present line of development is to continue, there will be a serious problem to be met some time, and that perhaps before many decades—the problem of a fuel suited to the needs of aeronautic prime movers, at a time when present petroleum sources will no longer yield the supply which we now accept and use with so little thought for the requirements of to-morrow.

But with regard to the question of fuels, we need not go so far afield as to look into the coming decades for interesting and important problems. Perhaps the one most pressing for present solution is the question of what is the best fuel for the modern aviation engine, having in view the three requirements—power, economy, with reliability and durability. Out of the exigencies of the present war have come many serious and extended researches relating to the problems of military aviation, and of these none is perhaps of greater significance regarding the future of commercial aviation than the studies which have been made regarding aviation fuels.

While matters relating to the problems of military aeronautics must be spoken of with much reserve, it will perhaps be permissible to say before this audience that from these studies three principal results seem to have been rather definitely established. These are:

(a) As between the various grades of aviation motor fuels which have been used during recent years, and comprising a rather wide range of composition and of physical and technical characteristics, there is but little to choose from the standpoint of power or economy alone. This assumes, of course, that the fuel is a genuine motor fuel and the results regarding power or economy relate to an assumed period of effective operation under such fuel. It must not, however, be assumed that there are no differences in power or economy traceable to the fuel employed, for such is far from being the case. It is, however, within the limits of reasonable statement to say that such differences are relatively small and under most circumstances would not, of themselves, constitute a determining or controlling factor.

(b) As between such motor fuels marked differences do seem to be indicated as regards their influence on the life and reliability of the motor, especially on long time tests, or in actual service on long time flights.

(c) For the various fuels, in order to realize the best results either as regards power, economy, or life and reliability, special and individual carburetor adjustments are necessary, and such as can only be determined by trial under actual working conditions.

Present Fuel Satisfactory

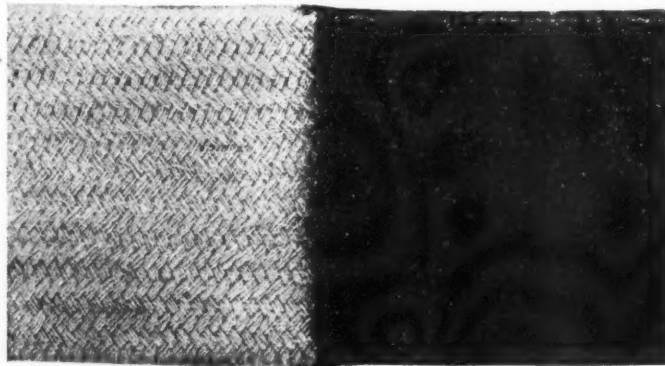
It may perhaps be further said that the problem of an excellent and reliable motor fuel for aviation purposes seems to have been satisfactorily solved. Its specifications and range of characteristics, physical and chemical, are pretty well established, and so long as our source of motor fuel supply is to be found in petroleum derivatives, we seem to have reached a reasonably satisfactory determination of the best combinations of such derivatives for the various requirements of aviation service. These characteristics, which must be considered as a part of the great body of military information and which cannot for the moment be put down in plain print, we may hope will, in due time, become available in the arts of peace and for the development of commercial aviation in its various fields of promise.

(To be continued.)

New Spring Lubricator

THE McCormick Laboratories Co., Dayton, Ohio, has investigated the problem of leaf spring lubrication and has developed an interleaf lubricator which, it claims, overcomes all the difficulties experienced with leaf springs when unlubricated or lubricated in the primitive way by means of a table knife or paddle. The interleaf lubrication evolved consists of a fabric tube which is slipped over every second leaf. This tube is impregnated with lubricant. With this lubricator, it is claimed, the spring leaf surfaces are permanently and uniformly lubricated, the compressible character of the tube compensates for inequalities in the leaves and makes for uniform distribution of pressure. The lubricator prevents water and grit from entering and consequently prevents rusty, frozen leaves.

The McCormick Laboratories Co. does only research and development work and is not engaged in manufacturing.



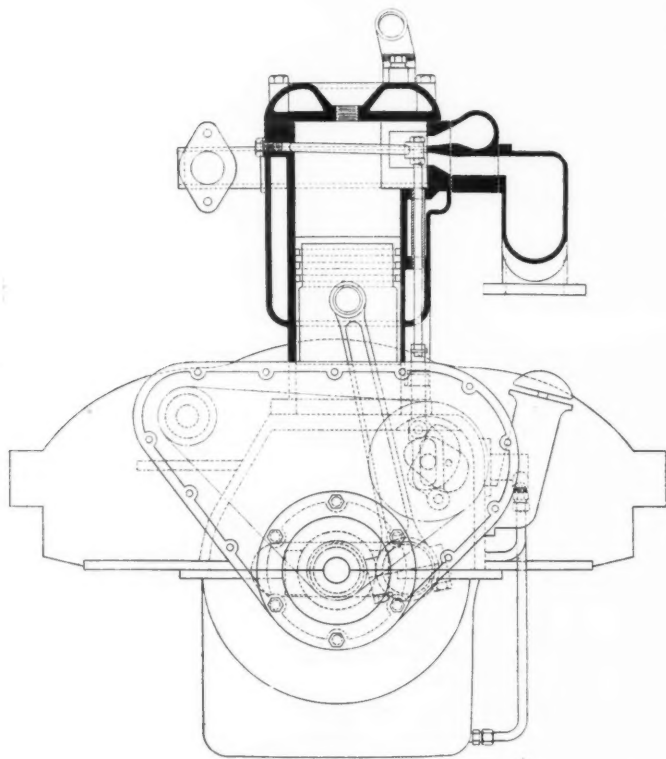
The fabric tube as used in interleaf lubrication

McElroy Kerosene Engine

Has Sliding Valve Positively Operated by Double Cam Mechanism—Fuel Charge Heated in Combined Inlet and Exhaust Manifold and Standard Carbureter Used

AN engine embodying a novel form of sliding valve and burning kerosene as well as gasoline is manufactured by the McElroy Engine Co., 909 Clifton Avenue, Newark, N. J. It is being regularly manufactured in small lots for stationary work, and several four-cylinder models for motor vehicle purposes have also been built.

The slide valve is of crescent shape and operates in a pocket turned eccentric with the cylinder at the upper end thereof. This sliding valve is moved up and down positively by a double cam mechanism on a half-speed shaft. One cam raises the valve and the other returns it. Each cam has a roller follower, and the two rollers are, of course, carried by the same push rod, which has an extension saddling the camshaft.

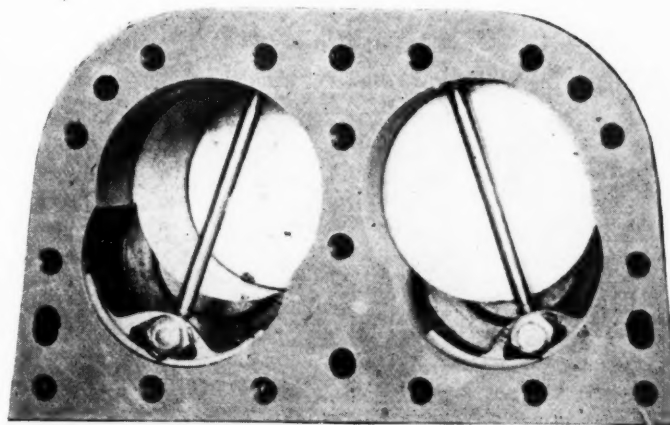


Sectional view through cylinder showing sliding valve and valve-operating mechanism

In order to prevent the slide valve from leaving its surface under the influence of suction in the cylinder it is held to same by a rod extending through the combustion chamber and having a spherical seat in the end of a screw screwed into the cylinder wall on the opposite side.

Inlet and exhaust ports are formed in the cylinder wall at the valve pocket, the inlet ports below and the exhaust ports directly above. The two manifolds are in one casting and as a result the incoming charge is heated by the hot wall of the exhaust passage. This is the only heat supply to the charge and is said to be sufficiently effective to permit kerosene to be used as fuel. An ordinary gasoline carbureter is used of any well known make. As a matter of fact, two carbureters are fitted, one for gasoline and the other for kerosene, and the two valves are interconnected, so that as one is opened the other is closed proportionally.

Other features of the engine are conventional. The cylin-



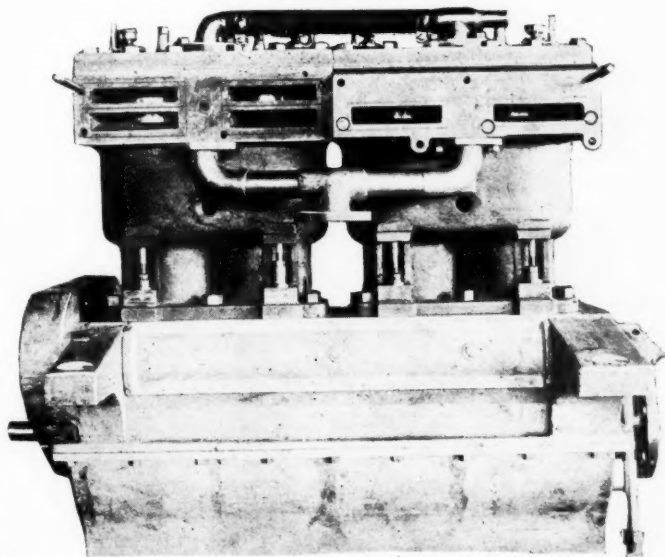
Top view of cylinders with cylinder heads removed and valves in place

der heads are detachable, which facilitates removal of the valves and cleaning of the combustion chambers when necessary. Camshaft and magneto shaft drive is by a silent chain. The crank case is divided in a horizontal plane through the crank axis. Lubrication is by the circulating splash system.

Book Review

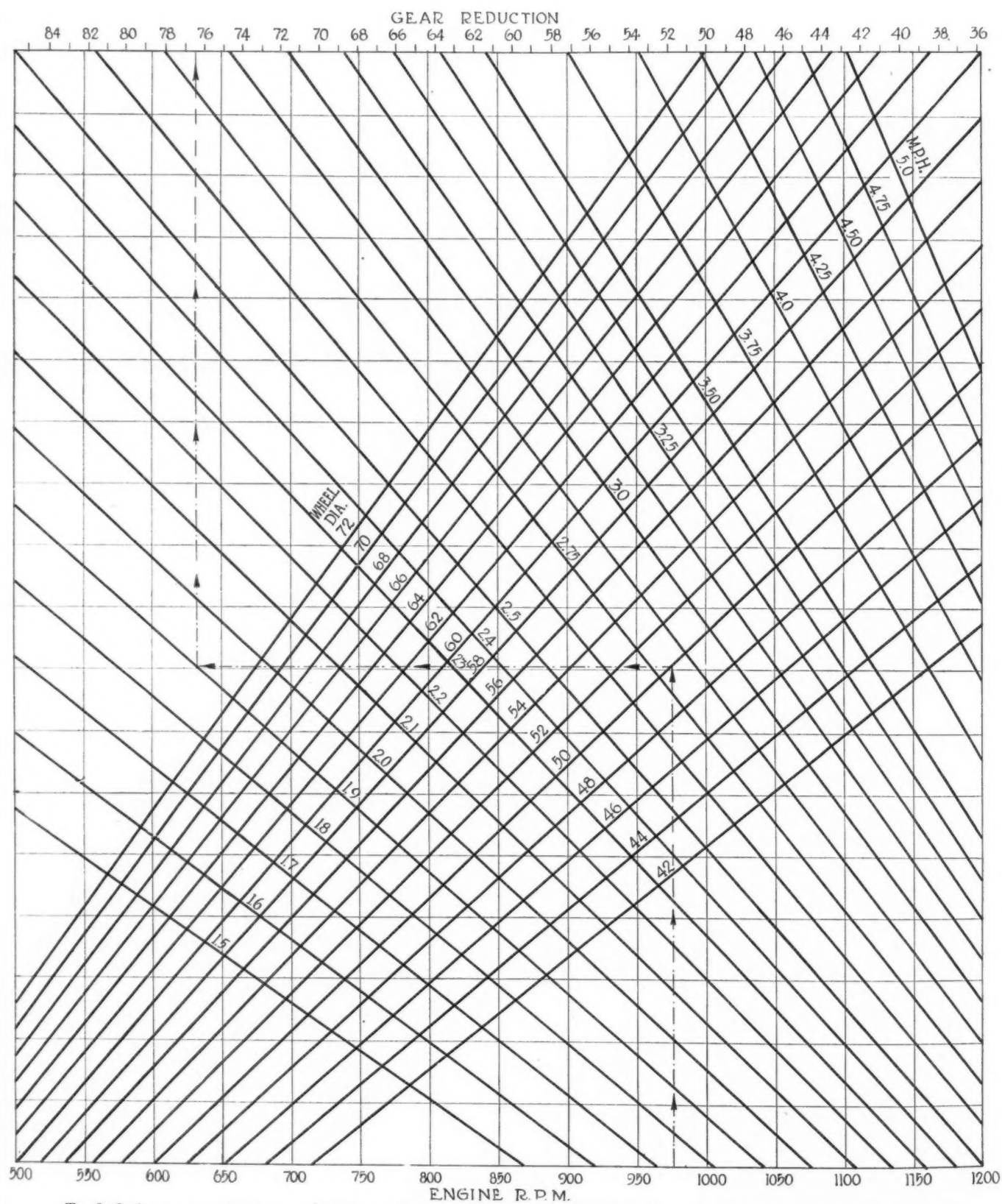
AUTOMOTIVE Magneto Ignition, by M. E. Toepel, published by Spon & Chamberlain, 120 Liberty Street, New York. 103 4½ x 7½ in. pages, bound in limp leather. Price, \$2.

This little book is intended as a guide to practical men having to look after magnetos on various types of automotive vehicles. It is in the form of a catechism, and contains some 200 questions and answers thereto. The author is at present engaged as instructor in the U. S. Government school for the study of magneto ignition, and apparently has had in mind the needs of his pupils. Reference to specific types of apparatus and minute details have been avoided, and the book is not descriptive in any sense.



The four-cylinder McElroy engine, showing inlet, and exhaust ports in cylinder walls

Tractor Gear Ratio Chart



To find the gear reduction required to give a certain tractor speed with a given engine speed and drive wheel diameter, proceed as illustrated by the example shown in dash-dotted lines. Start with the engine speed on the bottom scale, pass vertically up to the inclined line denoting the wheel diameter, then horizontally to the right or left to the inclined line denoting the tractor speed, and then vertically up to the top scale, where the required gear ratio may be read off

Entz Magnetic Transmission on Fifth Avenue Bus

SOME eight months ago the Fifth Avenue Coach Company, New York, installed an Entz magnetic transmission on one of its standard Model A buses, and placed the machine in regular service. Each of the buses operated by the company carries about 300 passengers per day, and as an average of four stops are made per passenger, it is readily realized that the strains on the clutch, brakes and transmission are very severe. With the Entz magnetic transmission no friction clutch is required, nor are there any clashing gears, and if this transmission could be properly developed for this particular service, a material saving might be effected.

The installation of the transmission was made by the Entz Motor Patents Corporation of New York, and was completed on November 28, 1917. The bus with Entz transmission complete weighed 10,180 lbs., of which 3,810 lbs. was on the front axle and 6,370 lbs. on the rear axle. This weight is made up of the chassis weight of 6,466 lbs., of which 3,150 lbs. is on the front axle and 3,316 lbs. on the rear axle, and of the body weight of 3,714 lbs., of which 660 lbs. is on the front axle and 3,054 lbs. on the rear axle. The bus with the Owen magnetic transmission is 890 lbs. heavier than the regular type A bus of the company.

During one month's service, ending January 6, 1918, the Owen magnetic equipped bus showed a fuel consumption of 1 gal. per 4.3 miles, as compared with 1 gal. per 5.4 miles for the standard type bus. This showing, however, was materially improved later on.

From December 6, 1917, to January 26, 1918, the bus

ran 4,605 miles. Between December 6, 1917, and January 19, 1918, it showed an oil consumption of one gallon per 244 miles. During the period from December 30, 1917, to January 26, 1918, the fuel consumption was at the rate of one gallon to 5.7 miles.

During the month of March the bus ran 2,495 miles. Between March 3 and March 31, 1918, the oil consumption was at the rate of 1 gal. per 279 miles, which was 64 per cent better than the showing of the standard A type bus, and the gas consumption was at the rate of 1 gal. per 5.6 miles, which was 12½ per cent worse than the standard type A bus.

During April and May the bus ran 4,887 miles and consumed gasoline at exactly the same rate as the standard type A bus and 33 per cent less oil than the standard type A. Between December 6, 1917, and May 31, 1918, the bus ran altogether 14,968 miles.

The troubles experienced during the period of observation were chiefly of a minor character, except that once the clutch and motor armature burned out, which was due to defective insulation. The driving shaft keys sheared off twice, and necessitated the installation of a new shaft and flange.

The engineers of the Fifth Avenue Bus Company consider the experiment with Owen magnetic very successful, but since the company has already committed itself to the straight gasoline bus, to the extent of 300 vehicles, no more magnetic equipped machines will be placed in regular service at the present time. For later orders the system will receive favorable consideration.

Vacuum Muffler Based on New Principle

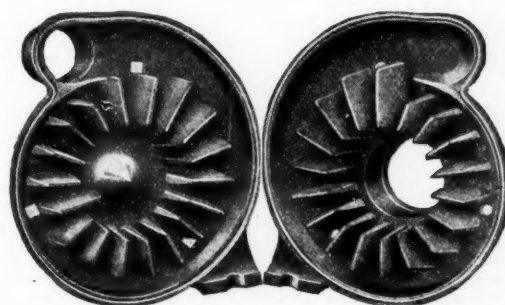
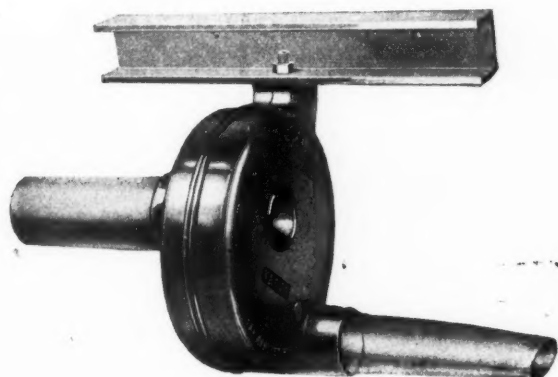
A MUFFLER based on an interesting principle is manufactured by the Vacuum Muffler Corp., New York City. It consists of two castings of flat cylindrical shape open on one side. On the inside of each are a large number of radial partitions, and the two castings are so fitted together that the partitions on one enter between those on the other. The exhaust gases enter the muffler through a central opening in one of the castings, and the stream is broken up by a cone cast on the other. It is thus divided into a large number of small streams, which pass around the circumference of the muffler and then unite in the common outlet. As the paths of the different small streams are of unequal length, the exhaust gases, instead of being discharged all at the same time, are discharged gradually, thus avoiding the loud noise which is produced if an engine exhausts through a comparatively free outlet.

What undoubtedly adds to the efficiency of the muffler is

the fact that the gases are given an excellent chance to cool rapidly.

It is quite understandable that this muffler offers but little back pressure to the exhaust, as the latter does not have to follow a zig-zag path nor encounter obstructions in the shape of plates with fine perforations. It is claimed for this muffler that it remains entirely free from carbon. This is probably due to the fact that the exhaust gases pass through every part of it at considerable speed and thus give the carbon no chance to settle.

According to a test made by Joseph Tracy, an engine fitted with one of these Vacuum mufflers gave 4 per cent more power than when exhausting directly into the atmosphere. The test was made on a four-cylinder 30-hp. motor, and when operating without a muffler the exhaust passed to the atmosphere through a 15-ft. length of 2½-in. pipe. The fuel efficiency was improved in the same proportion.



Left—Vacuum muffler mounted on car frame.
Above—The two castings composing the muffler

Preparing Men for War Tasks

General Motors Truck Co., Pontiac, Furnishes School to Train Men for the Sanitary Corps—Men Are Trained So They Can Repair Trucks Under Any Conditions

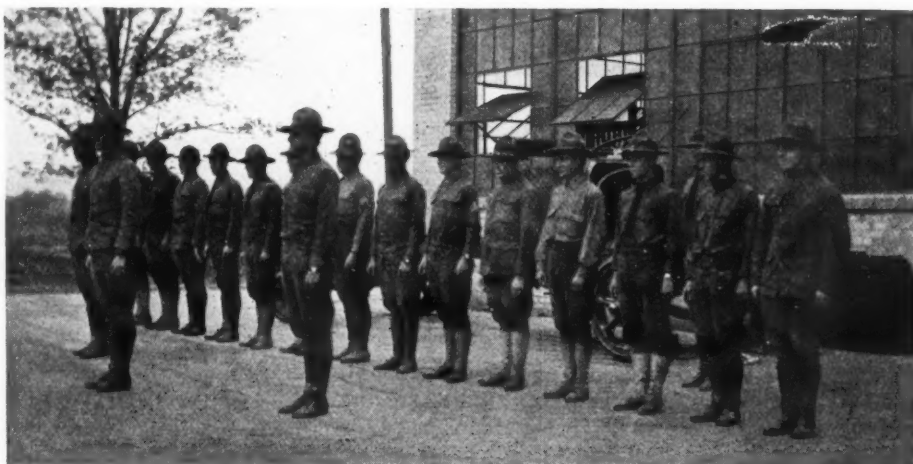
THEY call it "France"—the plant of the General Motors Truck Co., Pontiac, where men come from various cantonments for a thorough training in automobile mechanics for work in the Sanitary Corps of the United States Army. They work with tools that come with the truck, the same as they would in some isolated post in France. Under expert instructors they receive a 6 weeks' course, from which they are graduated to go overseas for duty on the battlefields or to cantonments to prepare other men.

The purpose of the course is to make the men so familiar with the parts of a truck that they will be able to recognize any part immediately and be able to properly adjust it in the least amount of time. They are taught just what parts to remove to repair others; how to interchange parts, and to replace any part that may have become defective through accident or wear and tear.

First Squad Came in December

The first squad came to the General Motors for training in December from the aviation section of the Signal Corps. Another company of men came from Allentown, Pa., March 1, and other cantonments also have sent men to the plant for training.

A systematic course is pursued. Before any actual work is done the newcomers are taken on a tour through the factory. They start with the foundry, where they are shown what pig iron looks like, whence they are taken into the factory, watching the machine develop step by



A company of men that came to the General Motors for training for the Sanitary Corps. All the men are under military supervision

step into the finished product. The class is accompanied by instructors, one to a squad composed of not more than ten men.

For the most part the class is composed of men who are theoretical or practical mechanics having been graduated from engineering courses in colleges or having had training that puts them above the ordinary automobile mechanics.

Ambulance Mechanism Studied

Having gone over the ground once and somewhat acquainted themselves with the course, the men start over again, this time specializing on the ambulance, analyzing each unit in minute detail. The frame and the method of mounting the various units on it are taken up first. The engine, clutch, transmission, rear axle and radiator



A company of men receiving instruction in the workings of a truck chassis



The men specialize on the ambulance. The training received at the plant enables them to maintain a truck

are next considered in turn. The engine, the most complicated part, is under discussion the longest period of time. A week is usually spent on this; 4 days are spent on the rear axle; 3 days on the clutch, and shorter periods on the other units. All this work is done by personal demonstration; all the parts are taken down and assembled by the men themselves with no other tools than those included in the regular equipment of the truck.

Having completed the course outlined in the foregoing, the men have a comprehensive idea of how to repair a truck, but they are not yet finished. They must be taught how to make adjustments and how to maintain the truck in service. Once again the men return to work on the engine for the purpose of acquiring a knowledge of making adjustments. Next the men are taught how to adjust steering rods, adjust tappets, grind valves, time magnetos, adjust carbureters, and all other service operations that may be called for "over there."

When the service of carbureters and magnetos is under discussion an expert on each is called in to give a talk on his respective line.

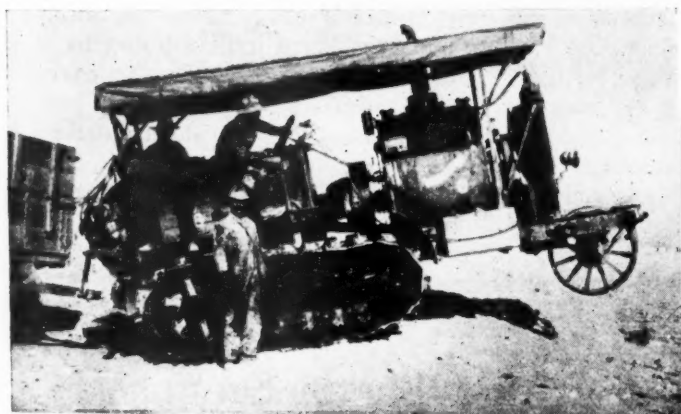
In all operations the shortest methods for replacing parts, repairing and making adjustments are taught. Time counts on the battlefield, especially in the ambulance unit, and the importance of this is not lost sight of in the course.

All the men attending the classes are under military discipline—all of them work from 8 to 10 hours a day and have one hour drill in the morning from 7 to 8 o'clock. Although under military supervision during the day, the men are privileged to go where they choose in the evening.

From the first bit of assembly through to the last, the Sanitary Corps follows the work carefully, in the knowledge that not the slightest detail of assembly can be missed. At the close of their training the men take two examinations, one written, the other demonstrative. It is necessary that both be passed with a certain grade. While both are extremely difficult, it is the demonstrative examination that meets with the most disfavor among the students.

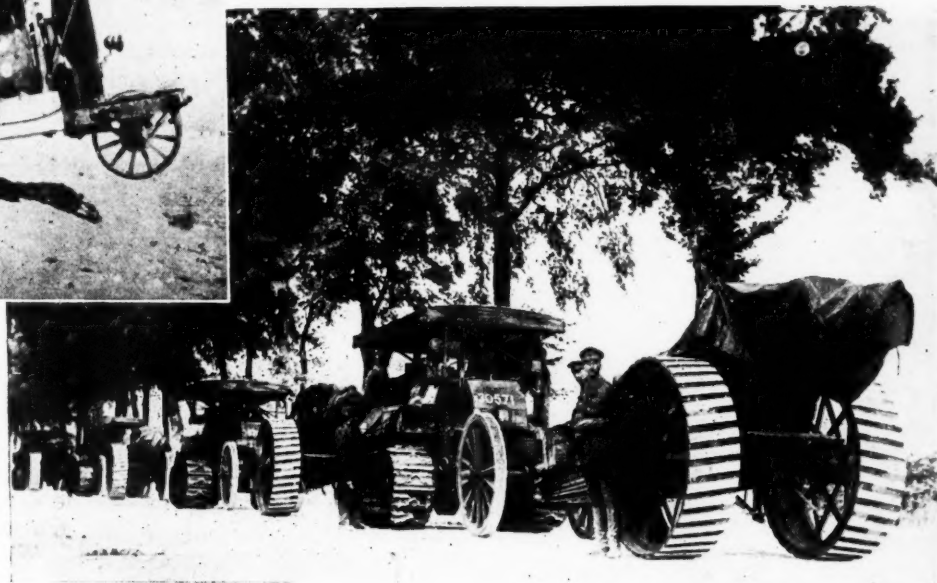
For this latter examination it is required of the men to assemble a truck. Next a truck that has been tampered with is given them, and they are asked to find the trouble. Every sort of trouble imaginable is met with, and thus far none has failed in this particular section of the examination.

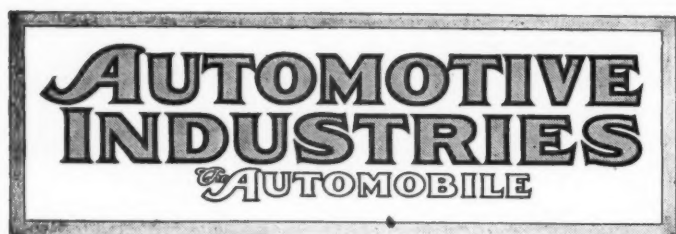
Instructors take keen delight in thinking up methods of tampering with trucks for this particular test. Among the things they do is to put small wooden plugs in the gasoline tube so that but a small amount of fuel will run into the carbureter.



The upper picture shows an American tractor crossing the Egyptian desert with the British Expeditionary Forces. The picture at the right shows more big guns being brought up in a recent British advance. In the lower picture tractors are hauling guns to firing positions during maneuvers at Fort Sill, Okla.

Tractors at Home and Abroad





PUBLISHED WEEKLY
Copyright 1918 by the Class Journal Co.

VOL. XXXIX Thursday, August 29, 1918 No. 9

THE CLASS JOURNAL COMPANY

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Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Do Not Force the Issue

"If the automobile industry would keep quiet, we could get up to 100 per cent of our steel requirements." This remark, made by the purchasing agent of one of the largest automobile factories in Detroit, sums up in a nutshell the opinion of many buyers of the industry.

The War Industries Board is a body of business men concerned with the winning of the war. Since the winning of the war is the biggest and most important business before this country at the present time, the wishes of this board take precedence over everything else in the country.

Since the War Industries Board is composed of good business men, it is but natural that when they are pinned in a corner by requirements for a ruling on material that they need, their first consideration is going to be what they require themselves. When asked to make a definite ruling, they are not going to estimate on a minimum but on a maximum. The result of this is that when the automobile industry

insists on a ruling regarding the amount of steel that it is to secure, the War Industries Board will take first into consideration the maximum amount which the War Industries Board will require to carry on its own business.

Steel authorities and those versed in manufacturing know that the War Industries Board *can never use up to the maximum* estimate of the steel it requires. They know that from month to month, as time goes on, there will always be a surplus over the amount required for war purposes. This surplus is large enough to take care of the important industries of the country to an extent fully in keeping with the reduced requirements of commercial manufacture, due to war-time conditions.

Purchasing agents for automobile factories have this well in mind. Their sympathy is not with those in the industry who insist on obtaining a definite ruling, with the result that the industry is in a hard and fast condition, with a minimum amount of material, instead of being in an elastic condition, with a quantity of material obtainable which would readily take care of the very limited demand now existing.

It does not take a minute of clear thinking to readily see that, regardless of all rulings and regardless of all requirements of commercial enterprises, the War Industries Board is first going to be served with the amount of steel it requires to carry out its program of winning the war. Over and beyond this quantity of steel, the highest authorities are agreed that there is sufficient to take ample care of industries working under a reduced war-time program. Let us stop forcing the war board into a corner where it is compelled against its wishes to make rulings which will not be favorable to continued commercial manufacture.

The Tractor Seat

THE average tractor is equipped with the regulation cast seat which has become standardized on sulky plows, binders and other agricultural machinery. Recently an attempt has been made to provide more comfortable seats for tractors, and this movement bids fair to gather force and lead to a complete change in the design of seats. It certainly seems reasonable that the tractor seat, which the farmer occupies almost without intermission from morning till night, should be at least as comfortable as his automobile seat, which he seldom occupies more than a couple of hours at a time.

Probably the habit of many farmers of leaving their machinery out in the open during long periods of non-use, exposed to the weather, had considerable to do with the adoption of the cast iron seat, for properly painted cast iron bears this treatment remarkably well. The provision of a comfortably upholstered seat with arm rests and back would appeal to some farmers as an improvement, while it might prejudice others as rendering the tractor less weather-proof. It might have the effect of inducing farmers to take better care of their tractors, to provide proper housing facilities and to put them up as soon as their work in the field is done.

Aircraft Report Unfair to Industry

Evidence in Hearings Shows Army, Navy and Government Departments Also at Fault

By DAVID BEECROFT

A PART from the justice or injustice of the aircraft report by the sub-committee of the Committee on Military Affairs, United States Senate, only one dominating conclusion can be reached, namely, that there is grave necessity for a supreme head of all aircraft activities; and while the appointment of John D. Ryan as an Assistant Secretary of War is a step in the right direction, it is only one step, and the satisfactory working out of the aircraft task cannot be accomplished until there is one head for all navy and army aircraft work.

A very large percentage of the thousands of delays referred to in the sub-committee report are due directly to poor organization of the Aircraft Production Board in the past. The board was really a dual entity, in that the executive power rested with the army and navy representatives on it, whereas the civilian members only had advisory power.

While the civilian members may be indirectly blamed for the progress of the aircraft program to-day, the fact must be understood that these civilians were without the necessary power, and it is unfortunate that they took up the position and placed themselves open to criticism under such conditions. Credit must be given these civilians for making literal sacrifices under such a situation, because it can only be said that their intentions and motives were of the highest order.

The 1220 pages of hearings conducted by the sub-committee bear out the fact that in army circles there was a decided lack of co-operation and desirable understanding, particularly between those in Europe and those at home.

General Kenly made the point quite clear in his evidence that orders from France given for one kind of plane were countermanded a few days later. Sometimes the countermand came some months later. This was true with the Spad order given to Curtiss, which was given at the direction of the military authorities in France, and which was later countermanded by these same authorities on the ground that the Spad was at that time an obsolete machine; yet it is to-day one of the best chasse or fighting types, and we are now proceeding with orders for the construction of a British type similar to the Spad.

The aircraft authorities in this country took their entire advice from the military authorities in France on this subject.

This is not cited as a criticism of the military authorities, but rather as an example of how necessary it is to have a single head for the entire aircraft task; and further, how necessary it is to have the closest unity between France and America in this work.

Another example of the lack of co-operation between the military and civilian members of the Aircraft Production Board was that the civilian members gave the go-ahead order on one type of bombing plane so that production could be started last fall, but it was months before the go-ahead order was executed by the military authorities.

No reason is given for the delay, but it is evidence of how necessary it is to have one-man control instead of having civilian members going over a certain task and making recommendations, and then apparently having more valuable time consumed by army or navy members going over the same field and several months later coming to the same conclusion.

The lack of one-man decision was also shown in the Liberty engine program, which was originally planned as an eight-cylinder design, and the development started as such, but changed to a twelve-cylinder design last fall under recommendations from France. Now that the twelve-cylinder design has been developed, it proves to be too powerful for the De Havilland 4 plane, which was adapted to its use. It seems that less power is actually needed for this two-man machine.

A one-man scheme of organization would have unquestionably prevented a great many delays and misunderstandings which have arisen due to the apparent failure of different factions to co-operate as they should have. There has been a serious delay and a slow program on the development of planes to meet engine requirements. Whether this has been due to holding off until the Liberty engine was thoroughly developed and its suitability for different types of planes ascertained, is not certain. It does appear that our bombing program is sadly delayed, part of which has already been explained.

We cannot but again refer to an editorial in these columns some months ago, in which it was recommended that more engineers be literally conscripted into the airplane engineering program, and that a corps of these be maintained as close as desirable to the combat field in France, and that the speediest courier service between those engineers and those at home be maintained.

The development of a complete airplane program is so enormous that no small group of engineers can possibly handle it. The work of differentiation is so wide that a corps of engineers with highly varying qualities is needed.

It is unfortunate that the automobile industry is so generously blamed for the present situation in the aircraft program. The report insinuates that there are other manufacturers in the country that could have handled the work to better advantage. This seems to be the one case in—*Continued on page 391.*

□ Latest News of the

Five Types of Planes Under Test

Include SE5, Bristol, De Haviland and Two Others—Pomilio Built in Indianapolis

WASHINGTON, Aug. 28—The SE5 plane, stated Mr. Ryan to-day in answer to an inquiry by a representative of AUTOMOTIVE INDUSTRIES, is still being used by British airmen. He would not comment on the fact that it has been replaced by four machines, each superior to the other in turn. Mr. Ryan also stated that we are adopting the latest Bristol, although the foreign experts report to the contrary.

"Liberty twelve-cylinder engine production," said Mr. Ryan, "is fully up to expectations. Orders for them have been increased from 22,000, which were ordered prior to last May, to 50,000. A large quantity of the Liberty eight-cylinder engines and also of the 150 hp. and 300 hp. Hispano-Suiza have been ordered. The eight-cylinder Liberty engine, which is a 250 hp., and the 180 hp. Hispano-Suiza are in quantity production. The 300 hp. Hispano-Suiza will soon be in quantity production."

We are now trying out five types of planes new to this country at Dayton, according to Mr. Ryan. These include the SE5, the Bristol exactly as made in England, a two-seated fighter plane especially designed for the Liberty engine by an ex-captain, and two other types which Mr. Ryan refused to discuss. All of these planes, he said, can be put in quantity production if they are found satisfactory.

Members of the Pomilio family, together with 30 designers and workmen, have just arrived in this country from Italy to work for the Department of Aircraft production in designing new planes, said Mr. Ryan. The Pomilio have sold their Italian airplane interests to the Ansaldo Co. The Pomilio organization will be located at Indianapolis. Mr. Ryan pointed out that the Government is using the services of every first class airplane designer in the country and mentioned such men as Glenn Curtiss and Glenn Martin and said all men of their standing are receiving every encouragement from him.

He stated that the changes in the De Haviland 4, as ordered by General Pershing, have previously been recommended by a representative of the original aircraft board who had been sent to England to observe the English manufacturers build the De Haviland 4 over there and will return to this country and file

a report just prior to General Pershing's.

Mr. Ryan also cited an American officer lately returned from France, who stated that the De Haviland Company itself is enthusiastic over the American De Haviland design.

He told this in refutation of the testimony of army officers and others who claimed that the De Haviland 4 is a dangerous machine to fly and is inefficient because it has been changed considerably in mechanism and structure. There has been no let-up in the De Haviland production, said Mr. Ryan.

Airplane engines, he said, are the real limiting factor in the air programs of all warring countries and we are therefore concentrating on engine production, not only to meet our own needs, but also to meet the demand of the allies who are clamoring for far more Liberty engines than we can produce.

Order 8000 Liberty Eights

DETROIT, Aug. 29—Special to AUTOMOTIVE INDUSTRIES—Dispelling all doubt regarding the purposes of the Aircraft Board in so far as the eight-cylinder Liberty engine is concerned, announcement has been made that contracts for 8000 of these already have been let. Of this total, the Willys-Overland Co. will produce 3000 in the Curtiss plant and the other 5000 is to be made by the Buick Motor Co.; production on both orders will be started soon. The Willys-Overland company is at present devoting fully two-thirds of its capacity to war work. The Elmira plant is 90 per cent on war work and the Elyria plant 75 per cent. The production of 8-in. shells will start next week in the new Toledo plant and the production of gun carriages has been started in another new plant. The passenger car output is now 300 cars daily. The production of the Curtiss company is now 800 planes monthly.

Redfield a Member of Priorities Committee

WASHINGTON, Aug. 27—William C. Redfield, Secretary of Commerce, was to-day appointed a member of the Priorities Committee of the War Industries Board. His appointment is regarded as distinctly advantageous to industries classed as non-war. Last week Secretary Redfield declared himself in favor of giving more attention to the so-called non-war industries, so that their organizations and factories will be kept intact for after-the-war trade.

It is reported that thousands of complaints have been made to official Washington recently against the shutting down of factories not producing war materials. Secretary Redfield favors priority rulings which will permit limited operation.

Ryan Heads Army Air Service

Appointed Second Assistant Secretary of War in Charge of All Army Air Activities

WASHINGTON, Aug. 28—John D. Ryan, director of the Bureau of Aircraft Investigation, has been appointed Second Assistant Secretary of War in charge not only of aircraft production but also of all military aeronautic activity. Major General William Kenly, head of the Department of Military Aeronautics, will hereafter report to Mr. Ryan. A new head of the Bureau of Aircraft Production will be named shortly by Mr. Ryan. Until the new director is named, W. C. Potter, assistant director of the bureau, will be the acting director, according to a statement made to-day by Mr. Ryan.

This consolidation of all military air activities under one head by Secretary Baker with the concurrence of the President virtually establishes an air ministry in line with the recommendations of the Senate Military Committee but with less powers than that committee desires.

The Senate Committee demanded a separate section to be controlled by a secretary of aeronautic operations, who was to be placed in supreme command, responsible only to the President. Under the new arrangement the army air service still remains a subsidiary of the War Department and Mr. Ryan is responsible to both Secretary Baker and President Wilson, while the naval air service remains under Captain N. E. Irwin, United States Navy.

Opinions expressed by both military and naval authorities are not in favor of a co-ordination of naval and military air operations. It is pointed out that our naval air program is radically different, involving questions of navigation and co-operation with the navy. Both Secretaries Daniels and Baker coincide with this view.

Financial Aid for Non-War Industries

WASHINGTON, Aug. 29—Financial aid will be afforded to all non-war industries suffering serious curtailment if a plan proposed to-day by Bernard M. Baruch, chairman of the War Industries Board, becomes effective. Mr. Baruch has pointed out to the Federal Reserve Board that all of the non-war industries requiring material which is needed for the war must be "skeletonized" and asks that financial aid be given to save them from being wrecked. The Federal Reserve Board is considering the suggestion.

Automotive Industries



Cut Car Production to 25%

War Industries Board to Allow Makers to Produce 50% During Remainder of Year

WASHINGTON, Aug. 26—Passenger-car manufacturers will be given steel sufficient to balance their inventories for a production, during the last 6 months of 1918, equal to 50 per cent of the production in the same period of 1917. Those makers who have more steel than this figure allows will turn over their excess supplies to other automobile factories which need it to complete their production.

The makers are further pledged to purchase no materials, equipment or supplies other than those needed to absolutely match up the stocks on hand. Upon meeting these conditions the manufacturer's requests for steel will receive preference treatment from the Priorities Division of the War Industries Board.

Urge 100 Per Cent War Work

No decision has been made regarding further supplies of steel to the industry following Jan. 1, 1919, but the board in its letter to the National Automobile Chamber of Commerce, setting forth the above, again urges the industry to use all possible haste in averting the plants for use in either direct or indirect war work.

These decisions by the War Industries Board are the results of meetings between the board and Hugh Chalmers and Alfred Reeves, representing the industry. The agreement finally arrived at by the board was expressed in a letter sent to the N. A. C. C. and signed by Alexander Legge, Edwin D. Parker, J. L. Replogle and George N. Peek.

Inventories Aggregate \$150,000,000

The letter points out the fact that the inventories of raw materials and semi-finished materials in the hands of the industry aggregate \$150,000,000, and that these cannot be liquidated without additional supplies of steel which will allow the makers to match up the various parts.

The magnitude of the industry, which had more than \$1,000,000,000 in 1917, was one of the primary considerations which influenced the decisions of the board according to the members. They stated that they believed that an industry of this size was entitled to all the assistance that could be legitimately given in enabling it to clean up its stocks.

Following is the full text of the letter sent to the N. A. C. C.:

National Automobile Chamber of Commerce,
7 East 42nd Street,
New York City.

"Supplementing our letter to you of the 9th instant we beg to advise that we have now received most of the reports embodying the data and information which we requested you to furnish us, and have given these reports careful study and consideration. From them it appears that the stocks of raw materials and of semi-finished materials in the hands of manufacturers of passenger automobiles, while large, are greatly unbalanced, with the result that these large stocks, aggregating approximately \$150,000,000, cannot be liquidated until they have been 'matched up' with other materials necessary to manufacture the completed cars.

"The conclusion has been reached that it is in the public interest, as well as in the interest of your industry, that it be assisted as far as practicable, without interfering with the war program, in the liquidation of its stocks now on hand; and to that end the Priorities Division of the War Industries Board will accord a degree of preference designed to accomplish this result, to all manufacturers of passenger automobiles who will subscribe to a pledge to be prescribed by the Priorities Commissioner embodying in substance the following:

"(1) That the manufacturer will limit its purchase of materials, equipment and supplies to such as are absolutely necessary to match up its stocks now on hand.

"(2) That its production of passenger automobiles, and all repair parts therefor, shall not for the six months ending with December 31st, 1918, exceed 25 per cent of its production for the calendar year 1917.

"(3) That it will conserve and economize in every possible way its stocks of iron and steel and their products now in its hands, or that may come into its possession, and will release on request of the War Industries Board to such other manufacturer of passenger automobiles as may be designated by the said Board such of its stocks as can be utilized by such other manufacturer and which are not required by it for either the limited production above specified or for war work.

"(4) That it will from time to time render such reports of its activities under oath or otherwise as may be called for by the War Industries Board.

"The War Industries Board will in carrying into effect the terms of the pledge herein provided for use as a basis, as far as applicable, the sworn reports recently rendered it in pursuance of its request.

"In justice to the passenger automobile industry we feel again impelled, as the situation appears to us now, to frankly repeat our statement to you of August 9th, that the urgent war requirements for iron and steel are so great that the probability of your industry procuring iron and steel after January 1st, 1919, for the manufacture of passenger automobiles is so uncertain that we again urge the members of your industry to as rapidly as possible utilize your facilities for the production of direct and indirect war requirements, not only in the interest of the Nation but in the interest of your industry itself. In such effort the members of your industry will have the active and wholehearted cooperation of this Board."

Gas Conservation Requested

Fuel Administration Urges Owners to Eliminate Sunday Motoring East of Mississippi

WASHINGTON, Aug. 28—Owners of passenger cars in States east of the Mississippi are requested to refrain from operating of their machines on Sundays by the Fuel Administration. Motor boating and motorcycling for pleasure are also barred. No mandatory order has been issued as yet. Owners are expected to voluntarily observe the request, which is effective beginning Sunday, Sept. 1. The request includes taxicabs. Exceptions are as follows, and include only motor vehicles used for necessary purposes:

Tractors and motor trucks employed in actual transportation of freight.

Vehicles of physicians, used in performance of professional duties.

Ambulances, fire apparatus, police patrol wagons, undertaker's wagons, and conveyances used for funerals.

Railway equipment using gasoline.

Repair outfits employed by telephone and public service companies.

Only voluntary compliance with the letter and spirit of the request will prevent the issuance of a mandatory order prohibiting the use of gasoline on Sundays, says the Fuel Administration. Nearly 3,000,000 automobiles, it is estimated, will be affected by the order, and it is expected that 9,000,000 gallons of gasoline will be saved each Sunday if the request is strictly observed. Dr. Garfield made it plain to-day that the Government believes automobile owners will observe the spirit of the request and that issuance of a mandatory order will not be needed.

The heavy demand for gasoline overseas for use in airplanes, tractors, tanks, trucks, passenger cars and motorcycles is the principal cause for this conservation measure, while, in addition, there is the large and constantly growing demand for fuel oil for many of the war machines. Heretofore by cracking processes it has been customary to take one barrel of gasoline from two barrels of crude oil. Owing to the exceedingly large demand for fuel oil this proportion is being reduced, and it is likely that shortly only 30 per cent of each barrel will be made to yield gasoline. While the stocks of gasoline and oils are always low at this time of the year, up to this year production has been slightly in excess of the demand. In July of this year, however, consumption was 29 per cent

(Continued on page 400)

St. Louis Develops Return Loads

Chamber of Commerce Traffic Department Distributes Useful Data

ST. LOUIS, Aug. 24—Under the leadership of the traffic department of the Chamber of Commerce the return loads bureau is making definite progress. During the last week P. W. Coyle, of the Chamber of Commerce, has sent to local shippers a letter giving the data concerning time-tables and warehouse facilities of five truck lines to towns 20 or more miles distant from St. Louis. A meeting has been called for this week, at which bills of lading and rate data will be discussed by the express line owners and managers of local truck companies.

It has been developed that the chief drawback to shipments by truck lines has been the failure to observe the time card. Also that the chief fault with a return load from the smaller city was the failure to maintain a warehouse where a bill of lading could be issued. These defects can be remedied.

H. R. Brashier, assistant to Traffic Commissioner Coyle, has taken up the warehouse work. It is expected that several of the St. Louis warehouses will be consolidated. Country produce off the Missouri side of the river and coal on the Illinois side have been offered for return loads.

At the last meeting W. F. Rehbein, branch manager here for the Garford Motor Truck Co., was chosen chairman of the Joint Interurban Motor Truck Service Committee.

Limited Supply of Coal for Michigan Passenger Car Industry

WASHINGTON, Aug. 24—The passenger car industry in Michigan will be limited in bituminous coal storage to a 20-day supply to be delivered after preferential industries, which includes the motor truck industry, are given a 45-day supply. The industry in other states will be limited to a 15-day supply after preferred industries receive a supply from 20 to 30 per cent. Public utilities will receive supplies ranging from 30 to 90 days before the non-preferred industries are supplied. All non-preferred industries are completely cut off from future shipments of by-products and gas coal.

Coal in excess of the above storage limitations, which are considered sufficient for current operations, will not be delivered to non-preferred plants for use before April 1, 1919, unless there is a surplus over the demands of the preferential consumers.

Studebaker Gun Carriage Christened

DETROIT, Aug. 24—Over 2000 munition workers of the Studebaker factories, 250 of whom were women in shop overalls, celebrated in fitting style the

christening of the first of the many siege gun carriages which they will turn out during the next few months. The carriage was christened "Black Jack."

American Import Restrictions Affect Ceylon Plumbago Output

THE plumbago industry in Ceylon is experiencing a period of stagnation, due chiefly to decreased shipments of graphite to the United States. Although the War Trade Board's restriction on plumbago imports has been a factor in this stagnation, there was a lessened demand on the part of American importers several months previous to the American restriction becoming effective. It is noted, for instance, says Consul Walter A. Leonard, that the plumbago shipped to the United States from Ceylon during the quarter ended March 31, 1918, totaled only 2194 tons, valued at \$405,064, according to invoices certified at this consulate, as against 6524 tons, valued at \$2,166,957, during the corresponding quarter in 1917.

In 1917 the United States took over 81 per cent of Ceylon's plumbago as compared with 75 per cent in 1916 (percentage based on quantity, not value), showing how dependent the industry is on the American market. The year 1917 was not quite as prosperous for the plumbago industry as the record year of 1916, when the total quantity exported was 668,216 hundredweight of 112 lbs., valued at \$7,298,128, as compared with 540,950 hundredweight valued at slightly less than \$6,500,000 in 1916. While the best grades of plumbago sold for as high as \$500 per ton during 1916 and 1917, half this price is not obtainable at present.

Unlike the tea and rubber industries, plumbago mining is largely in the hands of native Ceylonese, the majority of owners being men of small means with labor forces not usually numbering more than 20. Such owners must rely on an immediate sale of their graphite, and any marked fluctuations in the market will cause them to shut down or open up their mines. Thus it is observed that on June 30, 1917, when the market was good, 1288 mines were being operated, and employing 19,912 men, as compared with 764 mines at the end of the year employing 15,379 men. The small mines are obviously the ones first shut down in case of market depressions.

In 1916 the total output of Ceylon's graphite mines was over 33,000 long tons (of 2240 lbs.), compared with approximately 26,000 tons in 1917. Improved machinery, especially in working mines to greater depths, should enable Ceylon graphite to be mined at approximately the rate of 30,000 tons annually for many years to come.

Puritan Buys Broc Electric Parts

DETROIT, MICH., Aug. 24—The entire stock of parts for the Broc Electric, formerly made in Saginaw, Mich., has been bought by the Puritan Machine Co., of Tenth and Lafayette Avenues.

Location for Ford Mexican Plants

One Factory to Be at Monterey and Another Plant at Guadalajara

MONTEREY, MEXICO, Aug. 26—Locations for two of the proposed tractor manufacturing plants which Henry Ford plans to construct in Mexico have been tentatively selected and only await the formal approval of the Carranza Government for final decision. One of the plants is to be located at Monterey and the other one at Guadalajara. It is stated that the project embraces also the establishment here of a large automobile assembling plant. In the contract entered into between Mr. Ford and the Mexican Government it is stipulated that all of the raw materials and finished products entering into the manufacture of the tractors and automobiles shall be of native production. No difficulty will be experienced in complying with this requirement, it is expected. Steel may be obtained from the plant of the Monterey Iron & Steel Co.; timber is available in abundance; cotton and other fibers may be had for fabrics.

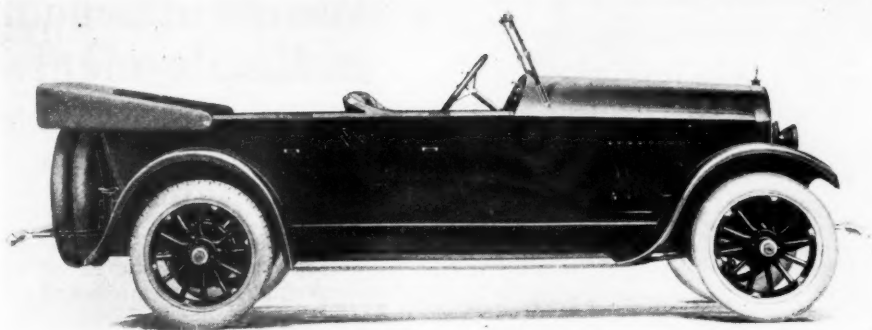
Exports to Holland and Denmark

WASHINGTON, Aug. 25—Passenger cars, bicycles, motorcycles and spare parts of these excepting tires and accessories will be considered for exportation to European Holland and Denmark proper by the War Trade Board, according to an announcement to-day. Prospective importers in European Holland must obtain import certificates from the Netherlands Overseas Trust Co., following which the importer must notify the prospective exporter of the serial number of the certificate. The exporter can then apply to the War Trade Board for an export license. This means that the shipments to European Holland, except those consigned to the Government of the Netherlands, must be consigned directly and only to the Netherlands Overseas Trust Co.

When importing merchandise to Denmark the importer must first obtain an import certificate from the Merchants' Guild of Copenhagen or the Danish Chamber of Manufacturers and then advise the exporter in the United States of the serial number. The exporter in turn can then secure his license from the War Trade Board. In the case of Denmark, shipments may be consigned to an individual.

Pennsylvania Rubber Declares Dividend

JEANNETTE, PA., Aug. 23—At a meeting of the board of directors of the Pennsylvania Rubber Co., held on Aug. 19, the regular quarterly dividend of 1½ per cent on preferred stock and 1½ per cent on common stock was declared, payable Sept. 30 to stockholders of record Sept. 15.



Characteristic straight line body design is evident in the new Westcott

Westcott Arrowline Seven

A New Model with Straight Body Lines and a Continental 9-N Engine
—Standard Parts Are Used Throughout

A new seven passenger model, known as the Arrowline Seven, has been announced by the Westcott Motor Co., Springfield, O. The body is of characteristic straight line design. The top line of the hood and cowl from the radiator to the instrument board is perfectly straight, and there is another straight line extending from the top line of the doors through to the radiator. The doors have sharp, square corners at top and bottom. The door handles are of tee design, with inside release, and the bumpers are of diamond bar shape.

This body is mounted on the standard Westcott six cylinder chassis, with a wheel base of 125 in. Cantilever springs are used at the rear, which combination permits of the use of a long body. The seats are pitched at an angle for comfortable riding, and the upholstery is very soft and deep. There is plenty of foot room for all of the seven passengers.

The front seat of the car is undivided, thus affording space for an additional passenger in an emergency. Between the disappearing seats in the rear is a small compartment for personal effects, which are secured against theft by a Yale lock, controlled by the same key as the ignition switch. Above this compartment swings a robe rail of leather. Tonneau and cabinet are illuminated by a small electric light. The instrument board is of walnut, and an unusual item of equipment is an electric signal lighter with extension cords.

The new Westcott is equipped with the Continental 9 N engine, of 3½ in. bore by 5½ in. stroke. Standard parts are used throughout the chassis, including the Delco starting, lighting and ignition system, the Rayfield carburetor, Gemmer steering gear, Fedders radiator, as well as oil cup lubrication, self acting top and thermostatic control of the temperature.

U. S. Light & Heat Corp. Elects Officers

NIAGARA FALLS, N. Y., Aug. 23—At the annual meeting of the stockholders of the U. S. Light & Heat Corp., held at the offices of the company, the

following directors were elected for the ensuing year:

Ralph C. Caples, Egbert H. Gold, Edwin K. Gordon, James E. Kepperly, Chauncey L. Lane, C. O. Mininger, James O. Moore, B. J. O'Reilly, James A. Roberts, George G. Shepard and J. Allan Smith.

The following officers were elected for the ensuing year:

Egbert H. Gold, chairman; J. Allan Smith, president; Chauncey L. Lane, vice-president and general manager; B. J. O'Reilly, treasurer; R. H. Van Nest, secretary; T. G. Swannie, assistant secretary and assistant treasurer.

Maxwell Motor Co. Calls Special Meeting

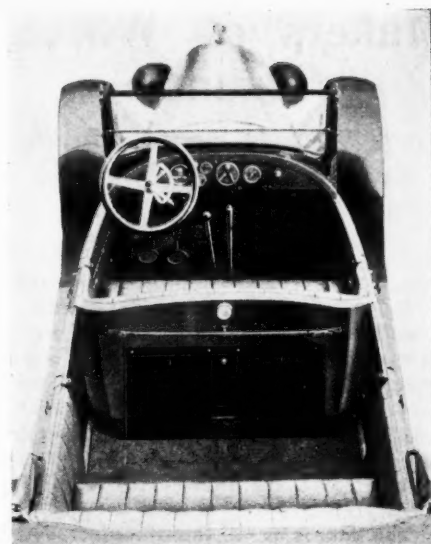
DETROIT, Aug. 26—A special meeting of the stockholders of the Maxwell Motor Co. has been called for September 5 for the purpose of considering and acting upon resolutions expressing the election of the company to have the moneys held by the Central Union Trust Co. applied to the purchase of shares of the first preferred stock for retirement.

Gutta-Joolatong Rubber May be Imported

WASHINGTON, Aug. 24—Importation of gutta-joolatong rubber which has been prohibited by the War Trade Board is now allowed to the extent of importing a limited amount necessary for essential purposes in this country during the remainder of the calendar year. The amount licensed for import will be allocated by the Bureau of Imports of the War Trade Board among manufacturers in accordance with their requirements for the production of commodities essential to the success of the war.

More Roads for Colorado

DENVER, Aug. 23—Plans for extensive development of Colorado highways, promotion and regulation of motor truck transportation and a general advancement of the motor car industry in this territory have just been decided upon



Interior of Westcott Arrowline Seven

at a Denver meeting of the executive committee of the Colorado Good Roads Association and the legislative committee of the Colorado Association of County Commissioners. The four main steps to be urged by a statewide campaign are:

- (1) An enabling act to give the people of the state an opportunity to vote on a bond issue for building and maintaining permanent highways throughout Colorado.
- (2) A transferring from the general fund to the state highway fund of all receipts from the state inheritance tax, now amounting to about \$150,000 yearly.
- (3) A doubling of the yearly motor car license fees, which are now far below those in effect in many states.
- (4) State traffic regulations aimed to give control over the speed of motor trucks, width of tires and other factors vitally affecting the wear of highways.

Want Tractor Exhibits in N. E.

BOSTON, Aug. 24—Efforts are being made to develop tractor sales in New England. Plans are under way now to try to get some interest aroused to have tractor contests at some of the numerous county fairs throughout New England in the fall. No section has a greater number of fairs for its size than the six states comprising the group up here.

Conveyor Increases Tractor Production

DEARBORN, MICH., Aug. 23—Henry Ford & Son have completed the installation of a conveyor in the plant in which final assembly is made. With the aid of this production has jumped upward and the daily output is now averaging 160. The production last week was 919 tractors as compared with 835 the week previous.

Liberty Gets Government Order

DETROIT, Aug. 24—The Liberty Motor Car Co. has received an order from the Government for 2500 two-wheel trailers similar to those the Paige-Detroit Co. is working on. The company's production of passenger cars for last month was 250, and is averaging 10 a day at present.

Makers of Wheels Organize

Form Association of Automotive Wheel Manufacturers for Co-operation

TOLEDO, Aug. 28—The Association of Automotive Wheel Manufacturers was formed in this city a few days ago when twelve concerns, representing practically all the makers of metal wheels and some of them representing wood wheel interests, met for the purpose of organization. The complete scope of organization has not yet been decided upon, but has been left to a committee of three, which will draft plans and present a report at the next meeting of the manufacturers' interests which will be held in September, perhaps in this city. The committee of three to carry out the organization is made up of Mark Merriman of the Hayes Wheel Co., H. A. Coffin of the Detroit Pressed Steel Co., and George L. Lavery of the West Steel Castings Co. The conception of the Association of Automotive Wheel Manufacturers dates back to 1917, when Washington had some misconception of the possibility of metal wheel manufacture and when it was assumed that the metal wheel production was limited to foundry capacity, whereas its limitation was confined to machine shop capacity. It was this misconception on the part of the Government which led manufacturers to see the necessity of co-operation in order that the wheel problem might be correctly presented where necessary.

The objects of the association are to investigate the promotion of engineering connected with wheel manufacture and also the mechanical problems connected therewith. The necessary research and investigation into various lines of automotive manufacture is also one of the spurs to action. Undoubtedly many problems relating to standardization will be considered by the association, not that it will pass upon the standardization work but rather that closer co-operation with the Society of Automotive Engineers can be carried out. The association has in mind the more complete co-operation of all makers in the field and the welding together of all interests. Among those present were:

A. H. Anthony, Massillon Steel Casting Co.
Edward H. Webb, Dayton Steel Wheel Co.
Geo. L. Lavery, West Steel Casting Co.
G. S. Porter, Hayes Wheel Co.
Mark Merriman, Hayes Wheel Co.
Ralph D. Webster, Wire Wheel Corp. of America.
R. F. Flinterman, Michigan Steel Casting Co.
Geo. Walther, Dayton Steel Foundry Co.
R. P. Flower, Standard Steel Casting Co.
A. L. Jelley, All-Steel Wheel Co.
W. E. Burns, Michigan Malleable Iron Co.

Replies from those favorable to the formation of an organization who were unable to attend were read from the following:

B. L. Smith, Smith Wheel Co.
Edward Budd, Budd Wheel Corp.
Isaac G. Johnson & Co.
Bertner Fleegeer, Sivyer Steel Casting Co.

Hanks Leaves S. A. E.

NEW YORK CITY, Aug. 28—M. W. Hanks, who has for over a year had charge of the standardization work of the Society of Automotive Engineers, has resigned, and connected himself with the navy as mechanical aeronautical engineer. It is in connection with standardization work in the navy that Mr. Hanks hopes to carry on the work he has been connected with in the past.

New Aviation Training System Adopted

WASHINGTON, Aug. 27—Experienced flying officers are now being returned from abroad to act as special instructors in the advanced courses of aviation training. Candidates for flying service consequently receive more individual training in this country. A new plan, known as the Gosport system, or "All Thru," as it is popularly called here, is used, which brings closer contact between the cadet and the instructor. When the cadets arrive at a flying field from the ground school, where they have learned much of the theory of flight, engine control and repair, radio, signaling, and other kindred subjects, several of them are assigned to an instructor, who stays with them until they have qualified in elemental flying. They are then sent to the special schools for final work, and training in their particular line, as pursuit, reconnaissance, artillery control, or bombing pilots. The old practice of giving a cadet so much time in the air under instruction, and then turning him loose for his first solo flight, in a "sink-or-swim" fashion, is being discontinued, and what is believed to be a more safe and sane system is being adopted.

Aviation Field Accidents Show Decrease

WASHINGTON, Aug. 27—Six deaths resulted at aviation fields in this country for the week ended Aug. 17. This represents but one fatality for every 3638 hours flown, or 291,040 miles of air travel. Following is the summary:

Brooks Field, San Antonio, Tex...	1
Carlstrom Field, Arcadia, Fla....	1
Carruthers Field, Benbrook, Tex..	1
Kelly Field, San Antonio, Tex....	1
Chanute Field, Rantoul, Ill.....	1
Post Field, Fort Sill, Okla.....	1
Total.....	6

Hart-Parr Dynamometer Performance

CHARLES CITY, IA., Aug. 26—The Hart-Parr Co. has given out the results of the dynamometer test on its 30-hp. tractor at the Salina demonstration. According to the official report, signed by Oscar W. Sjogren and C. K. Shedd, engineers in charge, the engine of the tractor gave an average output of 31.13 hp. at an average speed of 731.8 r.p.m. for a period of 30 min. According to A. W. Fitzpatrick, service manager of the company, the test was made at 12.30 p. m., when the Government thermometer was at 109 deg. in the shade, yet the temperature of the cooling water never rose above 175 deg.

Government Schools in Employment

Organizes Instruction Classes to Train Executives Without Charge

WASHINGTON, Aug. 26—The Government has organized a system of War Emergency Courses for the training of employment managers which has involved the creation of an advisory committee to set the general standards of instruction with the co-operation of a number of departments at Washington. These include the Ordnance Department, the Quartermaster Department, the Navy Department, the Department of Labor, the Emergency Fleet Corporation, the General Staff and other Government divisions. The policies of this committee are carried out by a staff organized as the Employment Management Division of the War Industries Board.

This division has secured the services of the foremost instructing authorities of the country on each individual subject dealt with. The subjects included in the course cover the organization and equipment of an employment department, the employing of the worker, training the worker, payment, control of working conditions, keeping the worker up to standard, the government of the shop, etc.

The means of instruction include systematic lectures by experienced teachers who will devote all their time to the work, and special lectures by experts who have had practical experience in specific lines. These are supplemented by studies made in efficient plants and other illustrations of given conditions.

To these courses employers are invited to send men or women of their own choosing, subject to the approval of the division. It is, of course, understood that those benefiting by attendance will return to their sponsors and be utilized by them in employment work.

Instruction is, in all cases, offered without any charge for tuition. The only outlay is for the living expenses of students while in residence and about \$15 for books and supplies. Application for admittance to any of these courses should be sent to Captain Boyd Fisher, 717 Thirteenth Street, N.W., Washington, D. C., who will furnish the necessary blanks, etc.

The following courses have been arranged and others will be announced later:

City	School	Date
Boston, Mass....	Harvard, Boston University and Massachusetts Institute of Technology co-operating.	Sept. 2
Rochester, N. Y..	University of Rochester	Sept. 16
Pittsburgh, Pa...	Carnegie Institute of Technology and University of Pittsburgh co-operating (tentative).	Sept. 23
New York, N. Y..	Columbia University.	Sept. (date not yet fixed).

Courses will follow at about eight-week intervals at each of these schools.

Imports of Rubber Drop Slightly

July Is 1198 Tons Behind Last July—Total for 6 Months Is 10,189 Tons Ahead

NEW YORK, Aug. 26—Importations of crude rubber dropped slightly during the month of July as compared with the previous month, though the total for the first six months of the year is well in excess of the total for the first six months of 1917. During July, 1918, a total of 16,092 tons was brought in, as compared with 17,290 tons in July, 1917, the drop amounting to 1,198 tons. July, 1918, showed a much greater drop when compared with June, the difference being a loss of 8022 tons.

During the first six months of 1918 the total amount of rubber brought in was 105,371 tons. This compares with 115,560 tons brought in during the first six months of 1918, making this year to date 10,189 tons ahead of last year. Following are the statistics as compiled by the Rubber Association of America:

Months	1917, Tons	1918, Tons
January	12,788	16,084
February	10,162	13,108
March	18,624	17,161
April	13,000	12,703
May	18,411	16,288
June	15,096	24,124
July	17,290	16,092
Total	105,371	115,560

Export of Tin Plate Regulated

WASHINGTON, Aug. 26—New regulations (W. T. B. R. 209) have been published by the War Trade Board governing the issuance of licenses for the exportation and manufacture of tin. Applications for licenses to export tin plate will only be received from the manufacturer, or, if the applicant is other than the manufacturer, when evidence satisfactory to the War Trade Board shall be furnished showing that the purchase of the tin plate to be exported has been made by the applicant directly from the manufacturer. A copy of the contract for such purchase shall be filed with the application.

Of more direct interest to concerns in the automotive and allied industries are the conditions governing the issuance of licenses for the exportation of bearing metals, anti-friction metals, white metals and tin alloys containing more than 5 per cent of tin; of solder containing more than 40 per cent of tin, and of tin foil, collapsible tin tubes, bottle caps or covers of tin foil containing more than 5 per cent of tin.

Applications for such licenses will be considered provided that, in the case of shipment to Canada or Newfoundland, evidence satisfactory to the War Trade Board is furnished showing that the

above-mentioned commodities are to be used for a purpose for which they may be used within the United States, and do not contain a percentage of tin higher or of a quality other than is requisite for the purpose to which they are to be put.

If the shipment is to other destinations, evidence must be furnished that it is intended for a purpose which will contribute directly to the successful prosecution of the war, and that the tin content of the bearing metals and solder does not consist of Straits tin or Banca tin.

If the tin content of the various alloys is less than given above, consideration of the application will be facilitated if it is accompanied by an affidavit from the manufacturer stating the amount of tin content.

Ford to Produce Thousands of Whippets

DETROIT, Aug. 26—The Ford Motor Co. has begun production of thousands of Whippet tanks of the small type for the Government, for which it has been awarded a contract amounting to millions of dollars. The Ford company has been experimenting for some time with the small tanks similar to those which recently achieved success on the western front, and is now in a position to manufacture them on a large scale. Before the contract was received, officials of the company stated that small tanks could be turned out with nearly as great rapidity as Ford cars, and it is expected the daily output of tanks will be extremely large. The exact size of the contract is not stated, but it is reported to be one of the largest received in Detroit.

Railroads Largest Steel Users

WASHINGTON, Aug. 23—A meeting yesterday between the War Industries Board, Dr. H. A. Garfield, Fuel Administrator; Carle Gray, representing the Railroad Administration; Felix Frankfurter, of the Department of Labor, with the War Service Committee of the Iron and Steel Institute and other steel makers, showed that the largest Government agency consuming steel is the railroads; next, ship builders; third, War Department, and fourth, the Navy Department. Discussion as to the best means of meeting these actual war requirements without possibility of curtailment resulted in decisions that there must be:

1. Greater conversion of mills to the production of steel that is required in the war program.
2. An increase in the coal supply, particularly by-products coal, available for mills engaged on Government work.
3. Shutting off further steel shipments to industries other than those engaged in meeting war needs.
4. More rigorous conservation in the handling of steel in the mills.

The steel men in the meeting promised to co-operate to their utmost in meeting the Government's steel requirements and virtually pledged themselves to so increase their output as to guarantee the needs of the war program.

Order 17,000 Class "A" Trucks

White, Packard, Peerless and Pierce-Arrow to Build Standardized White Trucks

WASHINGTON, Aug. 26—Following last week's announcement in AUTOMOTIVE INDUSTRIES of the reorganization of the motorized vehicle section of the army under the direction of the original regime which favored the standardized truck program, the following list of truck contracts has been made public. These contracts were made shortly before the reorganization took place and while the Motor Transport Service was under Col. F. M. Glover. The contracts were as follows:

White Co., Cleveland, 8000 "A" (White) 1½-ton trucks.

Peerless Motor Car Co., Cleveland, 3000 "A" (White) 1½-ton trucks.

Packard Motor Car Co., Detroit, 3000 "A" (White) 1½-ton trucks.

Pierce-Arrow Co., Buffalo, 3000 "A" (White) 1½-ton trucks.

These "A" trucks which were contracted for are the White 1½-ton trucks which were substituted for the original standardized "A" truck following tests held by Col. Glover together with the Ordnance Department.

These manufacturers have been allowed a price of \$2480 each for the trucks, and the Peerless, Packard and Pierce-Arrow companies have been allowed an additional \$100 for each truck for tool costs.

Col. C. B. Drake, whose nomination for Brigadier-General has been made, is already in active charge of the new Motor Transport Corps and Colonels Glover and George have been transferred to other army divisions. Col. Drake is at this time working out the organization of the new corps.

Saxon to Make AA Trucks

DETROIT, Aug. 26—The Saxon Motor Car Corp., Detroit, has received a sample of the 1-ton truck of the Class AA type and will start shortly on the manufacture of a quantity of these trucks, for which an order was recently received from the Government.

Milwaukee Wants Training School

MILWAUKEE, Aug. 26—Milwaukee, with thirteen large factories devoted to the manufacture of motors for passenger and commercial cars, trucks, tractors and aircraft, is making an effort to induce the War Department to locate a training school for automotive mechanics selected under the draft in this city. The Milwaukee County Council of Defense has been assured by each of the plants that they will assist in conducting and maintaining a school of this kind. It is pointed out that few cities in the United States have equal facilities for training soldiers in the construction, maintenance and repair of gas engines.

Labor Shortage Shuts War Plants

Non-War Industries Must Furnish Help—1,000,000 Workmen Needed

WASHINGTON, Aug. 24—A shortage of 1,000,000 unskilled workers, and a tremendously increased shortage over this figure in the near future, is announced by the United States Employment Service of the Department of Labor. Reports show that some of the most important war factories have been forced to shut down units because of lack of labor. The Employment Service has notified all state directors that the 1,000,000 shortage of men must be met by securing the labor from non-war industries.

Nathan A. Smyth, assistant director general of the United States Employment Service, pointed out that if this labor demand is not met promptly the new army which will be raised by increasing the present draft age limit may be faced by lack of equipment. Mr. Smyth said:

"The figures now brought together show to what great extent a shortage of unskilled labor is imperilling the work of America's war industries. The seriousness of the situation can scarcely be exaggerated. Instance after instance is coming to our attention where the lack of unskilled labor threatens to cause some highly essential war project to close down.

Available Labor Supply Depleted

"Though thousands of men have been moved by this service within the last 3 weeks, sometimes over great distances, we are confronted with the fact that available supplies of unemployed labor are practically depleted. Most of those who can now be found are of a restless, shifting type who will usually stay on the job only a little while, and are of slight value when there.

"As the army increases, the situation will grow more grave. The fact must be faced squarely and resolutely. There are plenty of men in the country to meet the present needs for unskilled labor, but they are now working at non-war work. The time has come when America must get fully on a war basis.

"If we are not to leave our armies in the lurch for the lack of munitions and supplies, every able-bodied man in the country will soon have to find work in some essential industry. Patriotic employers in non-war industries should take immediate steps to reduce their forces of men to an absolute minimum.

"An aroused public sentiment, which will brand as a slacker any man who willfully refrains from working at some productive job up to the full extent of his capacity, will be more effective than any laws or regulations.

"What, perhaps, is most needed in our war industries is an infusion of men who

will undertake to work as common laborers because of our country's need. Their presence will be an inspiration and example to those already at work and will go a long distance toward reducing the inefficiency and abnormal turnover of labor which exists at many important projects. Americans, like the English and the French, must learn that 'common labor,' when performed for one's country in time of war, is worthy of any man, whatever his prior position or experience."

In order to fill the present labor shortage, additional quotas of unskilled labor have been assigned to the various states, bringing the total to be supplied to 878,150, distributed as follows:

State Quotas to Fill Labor Shortage of 1,000,000 Unskilled Workers	
Alabama	4,050
Arizona	2,640
Arkansas	3,870
California	42,150
Colorado	10,120
Connecticut	16,340
Delaware	1,670
Florida	4,930
Georgia	6,070
Idaho	2,020
Illinois	78,670
Indiana	20,940
Iowa	11,350
Kansas	10,120
Kentucky	8,100
Louisiana	8,000
Maine	7,660
Maryland	14,310
Massachusetts	58,960
Michigan	24,110
Minnesota	18,390
Mississippi	2,200
Missouri	25,260
Montana	2,980
Nebraska	8,180
Nevada	1,580
New Hampshire	4,930
New Jersey	38,310
New Mexico	1,140
New York	169,140
North Carolina	4,310
North Dakota	1,850
Ohio	49,370
Oklahoma	7,570
Oregon	8,620
Pennsylvania	83,250
Rhode Island	9,420
South Carolina	2,820
Tennessee	6,780
Texas	14,260
Utah	4,140
Vermont	3,430
Virginia	8,980
Washington	22,180
West Virginia	7,570
Wisconsin	16,980
Wyoming	1,780

Giant Plane from St. Louis

ST. LOUIS, Aug. 26—W. E. Workman, general manager of the Handley-Page Aeroplane Mfg. Co., delivered a talk here last week to members of the Chamber of Commerce at a luncheon in which he told of factories to be built in this country. Immediately after the luncheon a movement was started to raise \$50,000 to build a giant plane here to fly to the war zone, where it will be offered in service. Some progress has been made in raising the fund.

New Physical Tests for Airmen

Medical Research Laboratory
Employs Apparatus Giving
Standard Examination

WASHINGTON, Aug. 24—All men who have won their wings in the United States Air Service are now required to pass a new heart, lung, ear and eye test to establish their physical and mental fitness when high in the air, and particularly to indicate at what heights they are in a condition to fly. Cadets receive a test before they finish their schooling; flyers are given these tests periodically to eliminate any whose physical or mental efficiency has become in any way impaired.

These tests are the result of study and investigation by the Medical Research Laboratory at Hazelhurst Field, Mineola, N. Y., whose staff has devised apparatus and determined upon a standard examination for classifying pilots.

To stay in the rarefied air at an elevation of 20,000 ft. for any length of time has been found to be a strain on even the most physically perfect. It has also been discovered that many of the most seasoned flyers cannot undergo the sudden quick changes in altitude, occasioned by diving and climbing, without physical deterioration. It was recognized as too great a risk to subject these men to actual flying tests, and so the medical laboratory at Hazelhurst Field undertook to devise some way of getting the same results by means of a ground test.

In the early tests the pilot was placed in a steel, airtight cylinder from which the air was gradually exhausted and then replaced, to simulate a flight into the rarefied air of high altitudes and back to earth, but to-day the pilot sits comfortably in the same room with his examiners. His nose is clamped so that he cannot breathe through it. Over his mouth is placed the breathing apparatus, which is connected by tubes with a tank of measured air and with instruments that record every breath he takes. The air is analyzed at various stages of the run. As fast as he exhales, the air is taken into a reservoir, where it is cleared of carbon dioxide, and then returned to the tank. Gradually he uses up the oxygen and thus air conditions of high altitudes are duplicated. The higher one goes up, the rarer the air becomes; just so with the man under test; after a certain time he has consumed an amount of oxygen which leaves the remaining supply just equal to the oxygen available at a certain altitude. Time takes the place of height in the test. "All the way up," so to speak, several specialists watch him—one his heart, pulse and blood pressure, one his eyes, and the others his responses to signals and observations. Records of his pulse and blood pressure are made every other minute. The eyes are tested every three minutes.

The man under test is kept fairly busy, just as he would be piloting a plane. Before him on a table is a bank of small electric lights, one or another of which flashes every five seconds. These he must extinguish as fast as he observes them and before they go out. He has but a few seconds. Below the lamps is a corresponding set of buttons which, when touched with a pointer held in the right hand, extinguishes the respective lights. The observers watch him constantly and check his errors or delayed actions.

Another instrument before him is an ammeter, which acts similarly to a speed dial on a plane, and, accordingly, in the test must be kept at a constant point. One of the examiners, out of view of the pilot, changes the pointer from time to time, and it is up to the pilot to rectify his dial by sliding his right hand along an instrument ar-

ranged to compensate for the change. These two duties keep his right hand pretty busy; his left arm is not used, as it has the blood pressure apparatus attached. He is also keeping a small electric fan motor at a constant speed, the variations in speed being indicated by changes in the hum of the motor; the corrections are effected by a foot treadle, similar to an accelerator on an automobile. His every movement is noted and recorded by the observers, who see if his heart, lungs and eyes accommodate themselves to the altitude.

As time goes on (and the test lasts for about 30 minutes), the pilot becomes a bit groggy or sleepy from lack of oxygen, just as he would at the corresponding altitude, and this condition becomes manifest in changes in the action of his heart, eyes, ears and brain. Along toward the end of his run he may let the motor slow down, forget the indicator entirely, or miss hitting the light buttons. But he is immediately released when his heart shows a strain or his pulse or respiration gets too far from the normal condition.

A few minutes after his release from the apparatus all signs of his recent fatigue pass away and he becomes normal again. But a very important record has been established, his future safety practically assured, and he himself feels that it would be absurd, in view of the facts shown by the tests, for him to try to fly out of his level. Where argument and theory did not convince some headstrong pilots before, they readily accept the inevitable when "shown" to-day.

There are now three classes of pilots; those few who can endure an altitude of over 20,000 ft. without undue fatigue are in class AA and are designated to fly pursuit planes when they reach the front, if they keep within the class in future tests. The men who can stand the work at 15,000 to 20,000 ft. are in class A; from 8,000 to 15,000 ft., class B, and those from the ground up to 8,000 ft., class C.

Future tests may show that some may be moved up a class, say from B to A, or that others may have to be moved down, both for their own good and the good of the service.

Electrical Apparatus and Supplies Classified as Essential

WASHINGTON, Aug. 22—The manufacturers of electrical apparatus and supplies will be classified as essential, according to a statement by the Priorities Commissioner to-day. Manufacturers of these commodities, however, will have to pledge themselves to limit their output to essential products and to insure that such products are devoted solely to essential uses as that term may be defined from time to time by the Priorities Division. The manufacturers will be relied upon to supervise their own industries and also the jobbers, distributors and retailers of electrical supplies. Jobbers of these commodities will be permitted to maintain reasonable stocks for sale to Government agencies, war industries and the civilian population, provided the jobbers will pledge themselves to rigidly restrict use of all stocks to solely essential uses and to reduce the jobbing and retail stocks to a minimum.

Traverse City Becomes Napoleon

TRAVERSE CITY, MICH., Aug. 26—The capital of the Traverse City Motor Car Co. has been increased from \$150,000 to \$500,000, and the name of the company changed to Napoleon Motors Co. Following are the new officers just elected: President, W. J. Chase; vice-president, C. E. Culver; secretary-treasurer, Frank Trude; chief engineer and general manager, K. W. Oswald; directors, the officers and J. W. Patchin, George H. Curtis and C. S. May. The company has been turning out 1- and 1½-ton trucks and three models of passenger cars.

Vestibule Schools Meeting Needs

Intensive Training in 100 Plants Overcoming Serious Skilled Labor Shortage

WASHINGTON, Aug. 23—The serious shortage of 250,000 skilled workers in this country is being met by the factory training school plan, which has often been referred to in AUTOMOTIVE INDUSTRIES, according to a statement by Samuel Gompers, Chairman of the Committee on Labor of the Council of National Defense. The factory training school plan has been adopted by more than 100 large concerns, each employing more than 300 people. It is estimated that 750,000 new skilled workers will be required by Jan. 1, and Mr. Gompers urges all employers to adopt the factory training school plan, which is being furthered by the Committee on Labor.

\$1,500,000 Yearly for Training

The 100 factories mentioned by Mr. Gompers are spending approximately \$1,500,000 a year in this business of intensive training of new workers. The training investment is not regarded as an expense as the training itself results in production which equals the production rate of the factory shops.

Outlining the work of the past year by the Committee on Labor, and the possibilities of increasing the numbers of skilled workers Mr. Gompers said that one year ago that section of the committee on labor of the Council of National Defense which has been instrumental in developing the training department or vestibule schools above noted recorded the following as its declaration of policy:

"The section on industrial training for the war emergency is concerned with industrial training only as a war measure. It is not concerned with vocational education in general. In all cases in the existing crisis shortage of labor must be met first by training operatives from allied trades who are unemployed and by advancing operatives of ability from lower to higher positions in the occupation itself. For instance, apprentices should be advanced rather than outsiders. It is possible that many sewing women will be without work, and many men in the building trades. For all such, new and fitting places must be developed where possible. Non-wage earners must not be trained to take places for which unemployed wage earners may reasonably be trained."

Aluminum Price Put at 33 Cents

WASHINGTON, Aug. 23—A maximum base price has been fixed on aluminum at 33 cents per lb. f.o.b. United States producing plants, for 50 tons and over, of ingot of 98 to 99 per cent. This price will be effective until March 1, 1919. It was approved by the President yesterday, following an agreement made

between producers of aluminum and the War Industries Board. Differentials for sheet, rod and wire and differentials for quantity, for grade and for alloys will remain those approved by the Price-Fixing Committee of the War Industries Board as effective from July 1, 1918.

These prices will be effective on deliveries made during the period from Sept. 1, 1918, to March 1, 1919, on contracts made during this period; and furthermore, the new prices will be effective on deliveries made during this period on existing contracts which specify that the price shall be that in force at the time of delivery. Deliveries made during the period of Sept. 1, 1918, to March 1, 1919, on other contracts will be at the price stated in such contracts, except that on existing "direct and indirect Government contracts" containing a provision that refund is to be made of the difference between the price stated in the contract and the "Government fixed price, if, as and when made," such difference shall be refunded on deliveries made during the period from Sept. 1, 1918, to March 1, 1919, on presentation of proper proof that the purchasing Government gets the benefit of the refund.

New List of Preferred Industries Being Formulated

WASHINGTON, Aug. 22—The War Industries Board is formulating a new list of preferred industries, which will be twice as long as the present preferred list, which contains 32 classes. The extension of the list is due to widely expanded war needs and pressing demands of civilian origin. This new list will be used as a key to the relative importance of all of the country's industrial enterprises. Each industry is being surveyed as to national needs and when the list is once established it will be maintained by a system of priority which will determine the use of the materials, facilities, fuel, transportation, labor and capital needed for them.

The War Industries Board is working with the War Finance Board in the creation of the new list.

An important point in this new list lies in the fact that it will be used as an indication of what constitutes war work. The War Department's "work or fight" ruling will be made by men who are engaged in any of the classes of the essential industries listed. The new table may be expected within a week.

Thirty-two Biggan Trailers Daily

CORUNA, MICH., Aug. 22—The daily output of the Biggan Trailer Co. will reach 32 trailers within a few days, or equal to 4 carloads. At the present time approximately 50 men are employed in the plant, which number will be greatly increased as soon as more men can be obtained. The company is working on a government order for 500 trailers for the aviation department and expects to enlarge its plant shortly.

Landing Field Chain Across Continent

Department of Military Aeronautics to Have Series of Fields 100 Miles Apart

WASHINGTON, Aug. 26—Construction of landing fields and training fields and enlargement of some of the existing fields have been ordered by the Department of Military Aeronautics. A chain of landing fields is being built across the continent at intervals of 100 miles. When they are completed they will be able to supply pilots, oil, gasoline, shelter, machine-shop facilities, maps, charts and barometer and thermometer ratings.

They are being built in New York, Pennsylvania, Ohio, Illinois, District of Columbia, Georgia, Texas, California, Arkansas, Mississippi, Alabama, New Mexico and Nebraska. The fields will no doubt enter largely into the location of future training fields, as they can be used for developing fliers, since they are sufficiently close to establish well defined air routes.

Bolling Field, District of Columbia, is to be improved by an expenditure of \$103,150. This field is being used for aerial patrol and protection of Washington as well as a training field for air service officers located in the capital. In addition to hangars and quarters sufficient for 23 officers and 154 enlisted men, there will be a balloon station with captive and free balloons for training observers. A photograph developing hut and a small radio telegraph station will also be features of this field.

The War Department now plans to train fliers in this country in squadrons to be shipped in such form to Europe instead of detachments as heretofore. Forty squadrons have been authorized. Four will be located at Houston, Texas, and thirty-six at Long Island, N. Y.

Major General William L. Kenly, Director of the Division of Military Aeronautics, states that this division is speeding up the training of fliers and is making ready to produce whatever number of fliers may be called for.

"Training schools," said General Kenly, "are now being grouped in districts so that the cadet fliers may pass from ground, primary, and advanced instruction all in one locality, and when the final test is passed be ready for France. It is also the intention as classes of these cadets finish their training as fliers to organize them into squadrons and brigades so that they may be sent overseas as such and take the air at the front in the formation in which they have been trained.

"Our study and observation and also the experience of officer instructors who have been overseas make us confident that this country offers the best training ground, not excepting England and France. This is primarily so because we have unlimited room here in the

United States. We are now equipping our flying fields with experienced instructors.

"In England and France the population is so great and uninhabited areas are so few and far between that it is difficult to locate even half a dozen training fields, to say nothing of several dozen. Over there, for instance, it is difficult to establish a gunnery school for fear of the damage that might be done to non-combatants or even to buildings. Gunnery schools require great areas of open ground in isolated districts. It is easy to locate such fields in the United States and at the same time have them accessible.

"The spirit of the West and the morale of officers and men, no matter whether they came from the North, East, South or West, is altogether splendid. They are absolutely fearless, show a high grade of intelligence and are bound to give a good account of themselves.

"One of the fields I visited was Mather Field at Sacramento, Cal. This field has a record of 250,000 hours of flying without a fatality. Another interesting place was the balloon field at Arcadia, Cal., where I saw seven balloons in the air at one time. The site of this field is a ranch back of which mountains rise to elevations the tops of which offer the same atmospheric conditions as the cadet gets suspended high in the air in the balloon basket. By taking the cadets up in these mountain tops, the instructors can train a large number at a time in observation and range-finding work, instead of limiting the classes to a few pairs in balloon baskets.

"We want good men in the Air Service, and we will need them in generous numbers. As soon as the new draft regulations are determined, I will venture to say that there will be unlimited opportunity for young men of the right calibre in flying schools and on the ground, for both this country and overseas."

Naval "Hydro" Station for Morehead City

GREENSBORO, N. C., Aug. 26—The location of army activities in Charlotte, Wilmington, Raleigh and Fayetteville is to be followed by the establishment of a naval aviation station at Morehead City.

The Secretary of the Navy indirectly has confirmed reports that a hydro-aeroplane station is to go to Morehead City. It is understood that the naval training station is to be located at Camp Glenn, a site hitherto used by the National Guard of North Carolina as a rifle range and training camp.

Oakland Employs Wives of Soldiers

PONTIAC, MICH., Aug. 26—The Oakland Motor Car Co. is giving the wives and sisters of employees who have gone into Government service preference in awarding factory positions. Women are employed in many departments, and the company reports they have proved themselves very efficient and versatile.

Dope Making Plants Nearly Ready

Eight Chemical Units for Aircraft Bureau to Produce All Ingredients for Dope

WASHINGTON, Aug. 26—Eight chemical manufacturing plants, built for the Bureau of Aircraft Production, estimated to cost \$7,000,000, are now nearing completion. They will produce the necessary ingredients used in the manufacture of "dope" for coating airplane surfaces, immense quantities of which are used monthly, last month's supply alone running into 200,000 gal.

There are two principal types of "dope" now in use in the U. S. Air Service: cellulose nitrate "dope," used on training planes, and cellulose acetate "dope," used on all planes shipped overseas. Acetate "dope," when properly made and applied, is believed to give a better, more permanent and less inflammable coating than nitrate "dope." The characteristics of acetate "dope" are important in connection with the use on combat planes which are subjected to attacks with incendiary bullets.

Early in the preparation of the air program a standard "dope" was adopted and steps were taken to overcome the shortage of the ingredients and chemicals for the manufacture of cellulose acetate "dope." To-day, American plants, operating for the chemicals section of the Bureau of Aircraft Production, are turning out such materials as acetate of lime, methyl alcohol, acetone, glacial acetic acid and methyl ethyl ketone. From these materials "dope" is manufactured by several firms throughout the country for release through the chemicals section to plane manufacturers, aviation schools, fields and supply departments in this country and abroad.

The general method of doping the wing surfaces is to apply three or four coats of the "dope," intervals of several hours elapsing between the application of each coat. Because of the volatile nature of the thinners of solvents used to dissolve the "dope," the liquid portion evaporates quickly and the air in the vicinity becomes laden with the slightly injurious vapors of the solvents. On account of this evaporation the major portion of the solvents is lost, but steps have been taken to preserve the health of the workers and also to recover the solvent. Approved methods for recovery now make it possible to save from 50 to 85 per cent of the solvents lost during the process of doping and drying. Special "dope" containers are also provided which will reduce evaporation.

Flags Fly on Milwaukee Plants

MILWAUKEE, Aug. 26—A service flag containing three gold stars, one silver star and 177 other stars was unfurled over the main office of the Wisconsin Motor Mfg. Co. at Milwaukee with impressive ceremonies on Aug. 23.

Federal Approval for Road Building

Beginning Next Month Road Material Cannot Be Delivered Without Formal Permission

WASHINGTON, Aug. 26—Federal approval will be required for all highway construction, according to the regulations made public to-day and effective next month, by the United States Highways Council, which governs highway and street work during the period of the war. Formation of this council was announced recently in these columns. It comprises representatives of the War Department, Agricultural Department, War Industries Board and Council of National Defense.

"No manufacturer," the council's announcement says, "will furnish any road-building material until the project has been approved by the United States Highways Council."

The proposed work that should be first submitted to the United States Highways Council through the appropriate State highway department is defined as follows:

"All proposed highway, street, culvert and bridge construction, reconstruction and maintenance involving: (a) the issuance of bonds; (b) the use of rail or water transportation; (c) the use of coal or oil as fuel; (d) the use of cement, brick, asphalt, oil, tar, crushed stone, or steel (also sand and gravel where shortage exists) as highway material."

The council urges that new highway and street construction be confined to most essential needs, and announces that it will give first consideration to the maintenance of highways already completed. Reconstruction is to be favorably considered only where it is clear that maintenance is no longer possible except at prohibitive cost.

New construction, it is announced, will be given consideration by the council in the following order:

First, highways and streets of military value, used regularly for the transportation of military supplies in considerable quantity, for the movement as an established practice of army-truck trains, or essential to the efficient operation of a military cantonment, post, or plant;

Second, highways and streets of national economic value, serving directly to promote the national welfare and not merely local welfare;

Third, unfinished contracts involving contractual obligations (incurred prior to April 5, 1918, where bond issue is involved) which may not be disturbed without serious consequences;

Fourth, streets and highways which although not of national economic importance are of extreme local importance, and the construction of which has progressed to such a point that serious hardship would be caused if their construction or completion should be postponed.

The council is soon to begin, in co-operation with the Bureau of Public Roads of the United States Department

of Agriculture, and the State highway departments, preparation of a program of road and street construction, reconstruction and maintenance throughout the United States for the working season of 1919.

The purpose is to approximate the character and amount of work deemed essential for 1919, with the amount and character of financing and materials involved, and the probable demand on rail and water transportation and labor supply. The preparation of the program in each State is to be in charge of the State highway department.

The United States Highways Council is composed of representatives from the Department of Agriculture, the War Department, the Railroad Administration, the War Industries Board, and the Fuel Administration. Logan Waller Page, director of the Bureau of Public Roads, is chairman of the council.

Airplane Ambulance Successful

WASHINGTON, Aug. 26—Following the successful operation of the first ambulance plane at Gerstner Field, Lake Charles, La., General Kenly, commanding the Division of Military Aeronautics, has had all flying field commanding officers supplied with photographs and drawings of this new emergency air carrier, with orders to complete the equipment at once. The nine Texas fields have already finished their equipment.

The airplane ambulance is used in reaching scenes of accidents occurring at a distance from the flying field hospitals and in localities difficult to reach quickly with automobile ambulances. It is in turn followed by an automobile ambulance by road or overland as fast as is possible.

A standard training plane is used for the new airplane ambulance with the rear cockpit cleared and enlarged sufficiently to permit of a combination stretcher-seat that allows the injured man to rest easily. He is slightly propped up with his head toward the pilot and his feet and legs extending into the fuselage. The patient is securely strapped in and made quite as comfortable as in a regular ambulance. The real value of the plane is its speed, but it also assures a far more gentle and comfortable trip than is to be had in a rolling and bumping automobile.

Limit Coal Storage in East

Fuel Administration Fixes Amounts Industrial Plants May Accumulate and Carry

WASHINGTON, Aug. 26—The tremendously increasing demand for coal for special war purposes in the eastern part of the country, particularly for the Navy and Transport Service, is making it necessary to draw more heavily on the Eastern coal fields than was originally contemplated.

It has therefore been decided to limit the amount of coal storage that industrial plants would be allowed to accumulate and to carry on hand and to fix a uniform amount that each State may accumulate.

United States Fuel Administrator Garfield announced the basic policy of the Fuel Administration as to storage as follows:

April, 1919, Deliveries for Excess Coal

"Coal in excess of that required for current operations shall be delivered to plants not on the preference list of the War Industries Board only when it is not in demand for use before April 1, 1919, by consumers on said list, namely, railroads, the Federal Government, states, counties, public utilities, retail dealers, or manufacturing plants on the Preference List.

"In carrying out this policy, allowance shall be made for differences in distance from the mines and for differences in transportation conditions which may require more or less storage at the beginning of winter to insure uninterrupted operation until the following spring."

The following report, framed by a committee of State Fuel Administrators aided by officials of the Administration, was adopted by the conference and concurred in by Dr. Garfield:

"The maximum limits of storage indicated for the several States or parts of States defined hereafter are as follows:

Maximum Number of Days Storage Bituminous Coal Allowed Until Further Notice

	Steam Coal		By-Product and Gas Coal			
	Public Utilities	Preferred Industries	Non-Preferred Industries	By-Product and Gas Plants	Preferred Industries	Non-Preferred Industries
Maine	120	90		120	90	0
Mass., Vt., N. H.,						
Northern N. Y.	90	60	30	90	60	0
Conn., R. I.	75	45	20	75	45	0
Southern N. Y., N. J.,						
Del., Eastern Pa.	30	30	15	45	30	0
Md., D. C., Va., N. C.,						
S. C., Ga., Fla.,						
Western Ohio.	30	30	15	45	20	0
Western Pa., W. Va.,						
Eastern Ky., Eastern						
Ohio	30	20	15	45	30	0
Lower Michigan.	90	45	20	60	60	0
Ill., Ind., Mo. ....	..	..	..	60	60	0
Wis., Minn., N. D.,						
S. D., Upper Mich. ..	..	..	..	90	90	0

Hare Made Packard Vice-President

DETROIT, Aug. 26—Emlen S. Hare has been elected to a vice-presidency of the Packard Motor Car Co., Detroit. He will retain his position as president of the Packard branch in New York, but will remove to Detroit within a few weeks. The rapid development of the Packard company's work for the Government has absorbed President Alvan Macauley's time and energies to an extent that warranted the creation of the new office for which Mr. Hare has been chosen. He joined the Packard forces early in 1916 in the capacity of special sales representative of both the New York and Philadelphia branches. Within 6 months he was given supervision of the truck department of the Packard Motor Co. of New York. A month later he was promoted to general manager, and later was made president.

J. J. Wright, for 2 years manager of the Ford branch at Memphis, has been promoted to manager of the branch at St. Louis, where new offices will be opened, the assembly plant there having been turned over to the United States. Wright succeeds W. C. Anderson, made manager of the assembly plant at Chicago. C. S. Williams, of the Louisville branch, becomes manager at Memphis.

Glen A. Sanford has been appointed sales manager of the rim division of the Jaxon Steel Products Co., Jackson, Mich.

B. A. Guy, secretary and assistant general manager of the Curtiss Aeroplane & Motors Corp., Buffalo, resigned Aug. 15.

R. T. Hodgkins has been appointed general sales manager of the Cleveland Tractor Co., Cleveland. For the past 4 years he was general sales manager of the Studebaker Corp., and previous to that was connected with the Yale & Towne Mfg. Co., New York.

L. S. Nold, formerly of the Electric Vehicle Co., also the General Electric Co., on Aug. 23 became identified with the Mitchell Motors Co. as secretary and treasurer. W. H. Armstrong, for 8 years secretary and treasurer of the Mitchell company, resigned to devote his time to other interests in Racine.

Bert B. Fornaciari, secretary and general manager of the Harvey Motor Truck Co., Harvey, Ill., for 9 years, has been appointed production manager and chief engineer of the Midland Motor Car & Truck Co., Oklahoma City. W. B. Burgess, in charge of the cost, time and stores departments of the Harvey company for 2½ years, and assistant to Fornaciari at Harvey, has also joined the Midland forces as assistant production manager.

C. B. Meyers has been appointed manager of the sales promotion department of the United States Motor Truck Co., Cincinnati. He has been with the company for 6 years, starting as stenographer

Men of the Industry

*Changes in Personnel and
Position*

Squires Will Leave Signal

DETROIT, Aug. 23—John Squires, chief engineer of the Signal Motor Truck Co., has handed in his resignation to the company to become effective Sept. 1 and will go into business for himself. S. Deutsch, vice-president of the company, will take up his duties when the position becomes vacated.

Hood Forms Garage Company

DETROIT, Aug. 26—Wallace C. Hood, who recently resigned as sales manager for the King Motor Car Co., Detroit, has formed the Foster-Hood Sales & Service Co. Mr. Foster was also formerly connected with the King company in the capacity of service manager. The Foster-King company will do general garage work, automobile painting, top recovering, etc., at 418 Jos. Campau Avenue.

and filling subsequently the positions of purchasing agent and sales manager from the time of its reorganization.

Charles M. Wallace, formerly purchasing agent of the Buda Motor Co., Harvey, Ill., and later with the Mitchell Motors Co., has been appointed manager of the purchasing department of the Erd Motor Co., Saginaw, Mich.

Ordnance Board on Metallurgical Matters

WASHINGTON, Aug. 26—In order to assure the more complete co-ordination of the various ordnance departmental activities along metallurgical lines, it has been decided to establish a Board on Metallurgical Matters. The appointment of this board will also assure the complete co-ordination of similar activities of the different divisions of the War Department and the War Industries Board.

The personnel of the board is as follows: Dr. G. W. Sargent, Engineering Division, chairman; Lieut.-Col. W. P. Barba, Production Division; Major A. E. White, Inspection Division, representing the Ordnance Department; Lieut.-Col. F. B. Richards, of the office of the Assistant Secretary of War; L. L. Summers, representing the War Industries Board, and William H. Smith, representing the manufacturers.

The board will act not only for the various sections of the Ordnance Department, but also in connection with the manufacturers working for and with the department in the production of war material, and will gather the most recent and complete information on all metallurgical products.

Swope Appointed Assistant to Baruch

WASHINGTON, Aug. 22—Herbert Bayard Swope has been appointed by the War Industries Board as an associate member. He will act as assistant to Chairman Bernard M. Baruch. Mr. Swope is a well-known editor who has studied war problems both in this country and abroad.

L. W. Hamilton has been elected president and general manager of the Lane Motor Truck Co., Kalamazoo, Mich., succeeding Dr. W. W. Lang, who has resigned. E. W. Bitzler has been appointed secretary and treasurer.

H. B. Garman has been appointed manager of the Detroit plant of the Steel Products Co. He was formerly superintendent of the plant, in which are manufactured drag links, brake and truss rods, propeller tubes, etc.

W. F. Winkleman has resigned as special representative for the Liberty Motor Car Co., Detroit, and is now associated with the Heath-Duplex department of the McCord Mfg. Co., Inc. He has been identified with the automobile industry for the past 12 years.

W. H. Yule, head of the mechanical goods department of the B. F. Goodrich Rubber Co., Akron, has been placed in direct charge of the company's relations with the Government. He has been in charge of mechanical goods sales for 2½ years, rising to that position from the managership of the Goodrich branch at New York City.

P. R. Preston, advertising manager, Rock Island Plow Co., Rock Island, Ill., has resigned and gone into the service with a machine gun company.

George V. McMahan, who was sales manager of the Detroit branch of the Remy Electric Co., has been promoted to assistant general manager of the Remy Electric factory at Anderson, Ind.

Alexander Dow, an inventor and a prominent witness in the Perlman rim case, has been commissioned a captain in the ordnance department. He is at present stationed at the Western Cartridge Co., East Alton, Ill.

Eagle No. 2 Launched at Rouge

DETROIT, Aug. 26—Eagle No. 1 is rapidly nearing completion at the Ford shipbuilding plant and will be ready to start shortly. Every piece of machinery, bolt and nut or piece of pipe used has been carefully measured and standardized, so that for all future boats everything will be ready to fit in place before launching. Eagle No. 2 was launched last Tuesday; Eagle No. 3 will leave the ways early this week, after which the chasers will go almost at the rate of one a day.

Janesville Starts New Plant

JANESVILLE, WIS., Aug. 26—The Janesville Machine Co., Janesville, Wis., recently acquired by the General Motors Corp., as the nucleus of a new tractor and implement manufacturing industry, has broken ground for the first unit of its proposed new tractor plant in Janesville. The main building will be 214 x 540, with a wing 50 x 250, and arranged for machining, assembling and erecting farm tractors. Later a complete foundry unit will be added. It is hoped to have the first unit ready by Nov. 1. In the meantime the original plant of the Janesville Machine Co. will be enlarged and changes made to make the production one of far implements, and tools suitable for tractor combinations. The initial investment in the new tractor plant will be approximately \$250,000. The Sampson sieve grip will be manufactured exclusively.

60 Per Cent General Motors Capacity War Work

DETROIT, Aug. 26—The General Motors Corp. is already on about a 60 per cent war work basis, and by winter it is believed 75 per cent of the capacity of all G. M. C. plants will be on a war basis. The Oldsmobile, Oakland, Chevrolet and Buick will all be truck producers, in addition to the G. M. C. Truck Co., Pontiac. The passenger car makers will produce $\frac{3}{4}$ to 1-ton models, while the G. M. C. Truck Co. has models of $\frac{3}{4}$ to 5 tons.

Brisk Blast Co. Reorganizes

MONROE, MICH., Aug. 23—The Brisk Blast Co., formerly of St. Louis, Mo., now located in Monroe, was recently reorganized, J. L. Phelps of St. Louis having disposed of his interests in the company. New officers of the company are: President, C. B. Southworth; vice-president and treasurer, Charles McIntyre; secretary, J. F. Meyer. This concern manufactures automobile accessories and airplane parts.

Remy to Have New Administration Building

ANDERSON, IND., Aug. 24—A new administration building is being erected by the Remy Electric Co. The general offices of the company have been moved into temporary quarters until the new building, which will occupy the ground where the old Remy administration building stood, is completed.

Hartford Plant for International Steel

MILWAUKEE, Aug. 26—The International Steel Products Co. has selected Hartford, Wis., as the location of its new plant, which will be devoted largely to the manufacture of the "Uvee" muffler. The concern has purchased a site of $3\frac{1}{2}$ acres near the plant of the Kissel Motor Car Co. at Hartford and will start building operations this week. Hartford capi-

Current News of Factories*Notes of New Plants—Old Ones Enlarged*

tal has taken a large financial interest and will be the controlling factor in the new works.

More Room for Schacht

CINCINNATI, Aug. 24—The Schacht Motor Truck Co. has begun the erection of an addition to its plant which will increase its capacity to 3000 trucks a year. It now turns out about 1200. The enlarged plant will employ about 800 men, and will cost about \$300,000. The new plant will be completed by the first of the year.

More Tractors From Peoria

PEORIA, Aug. 26—The Wilson Tractor Co. has been organized here and will have temporary headquarters at 213 South Water Street. The promoters will shortly open a factory to manufacture farm tractors. Articles of incorporation have been secured, the capital stock being fixed at \$5,000. The incorporators include J. B. Barrett, D. O. Wilson and M. E. Dryden. In the near future a factory site will be purchased and a building of large size erected.

Maxwell Production Down

DETROIT, Aug. 23—The Maxwell Motor Co., which has gone into war work on a large scale jointly with the Chalmers, has cut its production of passenger cars sharply. For the 6 months ended June 30 its output was about 50 per cent of the total of a year ago, or 22,000 cars, as against 43,500. Its truck production decreased from 12,000 to 4000.

13,979 Cars a Week on Akron-Cleveland Road

AKRON, Aug. 26—A striking illustration of the use of the highways by motor vehicles was presented by a census for a week taken in March of vehicles traveling over the 40-mile stretch of Ohio roads between Cleveland and Akron. The registration gave a total of 13,979 vehicles, of which only 685 were horse-drawn. Fifteen per cent of the total were motor trucks, which carried 5014 tons of freight, as compared to 6630 tons shipped by three railroads. Thirty-three thousand people were transported in passenger automobiles.

Packard Declares Dividend

The Packard Motor Car Co. has declared a regular quarterly dividend of $1\frac{1}{4}$ per cent on the preferred capital stock, payable Sept. 16 to stockholders of record Aug. 30.

Doehler Enlarges Plant

TOLEDO, Aug. 26—The Doehler Die Castings Co. has begun the erection of two new buildings, to cost \$100,000, which will be used principally for the manufacture of airplane bearings and other war products. One building, which will be an addition to the machine-shop, is to be 160 by 50, four stories high. The other, 50 by 120, will be a new foundry building. It is expected that the new buildings will be completed within 3 or 4 months. To obtain increased production, 500 employees will be taken on in addition to the 800 or 900 at present working in the plant.

A new department also will be started with the completion of the new machine-shop. Heretofore all aluminum die castings have been made in the Brooklyn plant. A large number of machines will be installed and the castings will be manufactured here.

The Doehler company has large Government contracts for war materials, including shells, depth bomb fuses and airplane parts, and recent contracts call for approximately 90 per cent of the airplane bearings used by the Government in all types of machines. Besides furnishing bearings for the new airplanes, the Doehler company already has made more than 500,000 bearings for United States aero training stations.

Reo Awarded Tractor Order

LANSING, Aug. 26—The Reo Motor Car Co. has been awarded an additional Government contract for artillery tractors, the quantity of which or the proposed date of delivery is held confidential. It is known, however, that the work on the second contract, supplementing the first award of 3000 tractors, will keep the Reo plant working to capacity for nearly a year.

The Reo company will continue to manufacture trucks until such time as steel needs conflict in any way with Government war needs. There are certain departments where the production of trucks will not interfere with tractor production, for the time being at least. The truck plant, which previous to the additional tractor contracts, had been converted into strictly a tractor production plant, is now shipping carloads of tractors daily on the original contract. Four milling machines are to be installed in this plant for work on tractor frames, each of which handles two tractor frames at a time. A 12-hour schedule is being maintained, with over-time work when necessary. To facilitate Government work the Reo baseball league has abandoned its schedule and there are no more Saturday half holidays.

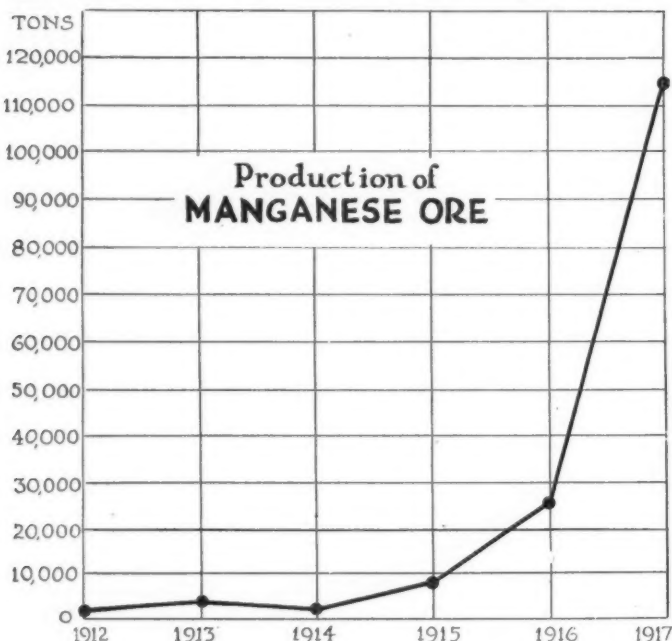
Overland to Make Liberty Engines

ELYRIA, OHIO, Aug. 26—The Willys-Overland plant in this city has announced it will begin the manufacture of eight and twelve-cylinder Liberty engines. The plant will operate 24 hr. a day, giving employment to more than 2000 men.

AUTOMOTIVE MATERIALS MARKETS

Material Market Prices

Acids:	10 oz., yd. .... .24
Muriatic, lb. .... .02-.03	Copper:
Phosphoric, ct. .... .35-.39	Elec., lb. .... .26
Sulphuric (60), lb. .... .09	Lake, lb. .... .26
Aluminum:	Cotton:
Ingot, lb. .... .33	Egypt, carded, lb. 1.20-1.30
Sheets (18 gage or	Peelers, combed, lb. 1.05-1.20
more), lb. .... .40	Peelers, carded, lb. .95-1.05
Antimony, lb. .... .14%-.14%	Fabric, Tire (17 1/2 oz.):
Burlap:	Sea Is., combed, lb. 1.65-1.70
8 oz., yd. .... .18 1/2	Egypt, combed, lb. 1.25-1.35



The annual production of manganese ore showed a decided increase in 1916. In 1917 the increase was tremendous

Fibre (1/4 in. sheet base), lb. .... .50
Graphite:
Ceylon, lb. .... .07 1/2-.25
Madagascar, lb. .... .10-.15
Mexican, lb. .... .03 3/4
Lead, lb. .... .08-.09
Leather:
Hides, lb. .... .18-.35 1/4
Nickel, lb. .... .40-.43
Oil:
Gasoline:
Auto., gal. .... .24 1/2
68 to 70 gal. .... .30 1/2
Lard:
Prime City, gal. 2.30
Ex. No. 1, gal. 1.60
Linseed, gal. .... .1.90
Menhaden (Brown),
gal. .... .1.25-1.27
Petroleum (crude),
Kansas, bbl. .... .2.25
Pennsylvania,
bbl. .... .4.00

Rubber:
Ceylon:
First latex pale
crepe, lb. .... .63
Brown, crepe, thin,
clear, lb. .... .60
Smoked, ribbed
sheets, lb. .... .62
Para:
Up River, fine, lb. .68
Up River, coarse,
lb. .... .40
Island, fine, lb. .59
Island, coarse lb. .97
Shellac (o range), gal. 7-3
Spelter .... .09 1/2-.09 3/4
Steel:
Angle beams and
channels, lb. .... .03
Automobile sheet
(see sp. table),
Cold rolled, lb. .... .06 1/2
Hot rolled, lb. .... .03 1/2
Tin .... .84
Tungsten, lb. .... .2.40 1/2
Waste (cotton), lb. .... .12 3/4-.17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only Per 100 lbs.	Primes when seconds up to 15 per cent are taken Per 100 lbs.
Automobile body stock.....	\$5.95	\$5.85
Automobile body stock, deep stamping..	6.20	6.19
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Automobile Sheet Extras for Extreme Widths:		
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.		
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.		
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.		
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.		
Black Sheet Extras to Apply to Narrow Widths:		
Oiling, 10c. per 100 lb.		
Patent leveling, 25c. per 100 lb.		
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.		
Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.		

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	62	64	..
*J. I. Case T. M. Co., pfd.	80	83 1/2	..
Chalmers Motor Co., com.	4 1/2	5 1/2	..
Chalmers Motor Co., pfd.	20	30	..
*Chandler Motor Car Co.	87 1/2	89	+1 1/2
Chevrolet Motor Co.	139	141	+7
*Fisher Body Corp., com.	36	36 3/4	- 1/2
*Fisher Body Corp., pfd.	89 3/4	91	- 1/2
Fisk Rubber Co., com.	60	61	+1
Fisk Rubber Co., 1st pfd.	98	103	-1
Fiak Rubber Co., 2nd pfd.	78	83	..
Firestone Tire & Rubber Co., com.	104	108	-2
Firestone Tire & Rubber Co., pfd.	94	96	..
*General Motors Co., com.	162	164	+9
*General Motors Co., pfd.	81 1/2	81 3/4	+ 3/8
*B. F. Goodrich Co., com.	44	45	-1 1/4
*B. F. Goodrich Co., pfd.	98 3/4	100 1/2	..
Goodyear Tire & Rubber Co., com.	150	155	-2
Goodyear Tire & Rubber Co., pfd.	97 1/2	98 1/2	..
Grant Motor Car Corp.	2 1/4	3	- 3/4
Hupp Motor Car Corp., com.	2 1/2	3 1/2	- 1/2
Hupp Motor Car Corp., pfd.	78	80	-1
International Motor Co., com.	27	32	+2
International Motor Co., 1st pfd.	50	55	-10
International Motor Co., 2nd pfd.	36	40	+1
*Kelly-Springfield Tire Co., com.	48	49	-1
*Kelly-Springfield Tire Co., pfd.	80	87	..
*Lee Rubber & Tire Corp.	19 1/2	20	-2 1/2
*Maxwell Motor Co., Inc., com.	26	27	+ 1/4
*Maxwell Motor Co., Inc., 1st pfd.	56 1/2	57	+2
*Maxwell Motor Co., Inc., 2nd pfd.	20 1/4	20 3/4	+ 3/4
Miller Rubber Co., com.	105	108	..
Miller Rubber Co., pfd.	95	97	..
Packard Motor Car Co., com.	110	120	..
Packard Motor Car Co., pfd.	94	97	..
Paige-Detroit Motor Car Co.	17	19	..
Peerless Truck & Motor Corp.	15	17	+1
Portage Rubber Co.	106	108	-4

	Bid	Asked	Net Ch'ge
Reo Motor Car Co.	14 1/2	15 1/4	+ 1/2
*Saxon Motor Car Corp.	6 3/4	7 1/2	- 3/8
Standard Motor Construction Co.	12 1/2	13	- 1/2
Standard Parts	60 1/4	61	+10 1/4
*Stewart-Warner Speed. Corp.	56 1/2	57 1/2	..
*Studebaker Corp., com.	43 1/2	44 1/4	-1 1/4
*Studebaker Corp., pfd.	81 1/2	90	-3 1/2
Swinehart Tire & Rubber Co.	45	55	-1
United Motors Corp.	32 3/4	33 1/2	+1 1/4
*U. S. Rubber Co., com.	62 1/4	63	+1 1/4
*U. S. Rubber Co., pfd.	104 1/2	105 1/2	+ 1/4
*White Motor Co.	45 1/4	46 1/2	..
*Willys-Overland Co., com.	19 1/4	19 3/4	..
*Willys-Overland Co., pfd.	81 1/4	83 1/2	- 1/2

*At close of business Aug. 27. Listed N. Y. Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE
ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co. ....	..	7 1/4	..
Bower Roller Bearing Co.	16 1/2	..	..
Chevrolet Motor Co.	135	140	+2
Continental Motor Co., com.	5 3/4	5 3/4	+ 1/8
Continental Motor Co., pfd. ....	..	..	..
Edmunds & Jones, com.	14	17	..
Edmunds & Jones, pfd.	75	90	..
Ford Motor Co. of Canada.	149	156 1/2	+2
Hall Lamp Co. ....	..	14 1/2	..
Michigan Stamping Co.	12 3/4	..	..
Packard Motor Car Co., com. ....	..	120	..
Packard Motor Car Co., pfd. ....	..	94	..
Paige-Detroit Motor Car Co. ....	..	17 1/4	..
Prudden Wheel Co.	9 1/4	10 1/4	..
Reo Motor Car Co.	14 1/2	15	..

INACTIVE STOCKS

Atlas Drop Forge Co. ....	..	25	..
Kelsey Wheel Co.	25	..	..

Industrial Review of the Week

A Summary of Major Developments in Other Fields

Production of Bituminous Continues to Decrease

Production of bituminous coal continues to decrease in spite of all efforts made by operators and Fuel Administration officials to speed up production. The causes for the poor output still remain the chronic ones of insufficient cars and slacker labor. Many of the producing districts report that their operations have been forced to suspend for periods ranging from half a day to four days because they were given no cars to load. Not only does this poor transportation situation result in meager tonnages, but patriotic labor that is anxious to prove its good intentions toward the country at the present time is denied the opportunity to work steadily.

During the week ended Aug. 17 inadequate car supply and labor shortage combined to keep the output of soft coal down to 11,910,000 net tons, which is far below the weekly figure of 14,270,000 net tons considered necessary to meet essential demands. It is a foregone conclusion that some drastic policy will have to be put into effect if war work is not to suffer, and an intimation of the manner in which the situation will be met is indicated by the announcement of the Fuel Administration that stocks of steam, by-product and gas coals are not to be hoarded, regardless of whether the consumer with the reserve stores is in a preferred or non-preferred industry. Mandatory limits have been set on the number of days' supply of fuel which may be stored by industries in different sections of the country, and the Fuel Administration will see to it that these limits are not exceeded.

The movement of coal to the Northwest shows signs of improvement, though the tonnage is still considerably behind pre-season estimate. Bituminous coal loaded on vessels at lake docks during the week ended Aug. 17 amounted to 1,109,611 net tons, an increase over the week preceding of 85,192 net tons. Supreme efforts will be required if the Northwest's requirements are to be met before the close of the lake season.—*Coal Age*.

Aircraft Report Unfair to Industry (Continued from page 377)

which the committee gets away from the European parallel and apparently forgets entirely that the aircraft development in England, France, Italy and Germany was carried on entirely by the automobile industry, and that it was the logical industry, and the only one well fitted to take up the work. We cannot see where any other industry could have been found so well qualified to do the work in America.

The report seems in many places to be based on the complaints of some aircraft manufacturers that were in existence

previous to the war, but who had no conception of or facilities for production manufacture. Those from the automobile industry who entered into the aircraft program have been criticized on the grounds of favoring the industry, which criticism has been unjust. It would be impossible to find manufacturers better qualified to carry on the work than those who had been given the task.

It is true that the orders might have been spread over more companies, as has been done in England. This, of course, would have worked against production, and undoubtedly those in charge of the program had in mind concentrating production in a few large companies in order to meet the requirements.

The question of manufacturing tools and jigs for production, and the enormous difficulties involved, has not been given due consideration in the report. The spirit of the report seems to be a general condemnation of the aircraft activity to date, and after reading the evidence of many who were heard by the committee you cannot but conclude that the report is unfair to the industry. It has not given that prominence to much of the evidence that should have been brought out in the report. It savors too much of nailing the complete responsibility on an industry and whitewashing the Government side of the question. It is not fair to censure one and overlook the other.

The report will have one value, if its general circulation in America is permitted, namely, that of educating the public to a great extent on aircraft. Practically every person examined in connection with it admitted the greatness of the task and the inexperience of the nation.

This report should serve as a great educator. It is true it tells some unpleasant things, some that will have a depressing effect throughout the country; but we are in war, and must lay our cards on the table. If we have to go through the fire and water, let us do so now, and get on firm ground, so that we can correct those abuses of government and industry which have taken place in the last 16 months.

General Motors Increases Stock

WILMINGTON, DEL., Aug. 27—At a special meeting of the stockholders of the General Motors Corp it was voted to increase the capital stock from \$200,000,000 to \$300,000,000. The preferred stock was increased from \$50,000,000 to \$100,000,000, and the common from \$150,000,000 to \$200,000,000. A bonus plan providing for the distribution of 10 per cent of the net earnings each year to the employees of subsidiary companies as a reward for their part in the success of the respective subsidiaries was also approved.

23,000,000 Tons of Steel Needed Before End of Year

With more emphasis than ever the War Industries Board has put before the steel trade in the past week the imperative call for rails, plates and shell steel. New needs cabled from France have added to the gap between capacity and requirements, and the amount now wanted in the last four months of the year will bring the total for the second half up to 23,000,000 tons, as against an estimate of 20,000,000 tons early in July and probable production of 17 to 18 millions for the six months.

Yet output does not increase, and every nerve must be strained to make up in September for the inroad made by an unusual number of hot and highly humid days in August.

A swelling of overseas demand, due to the aggressive activities of the Allied forces, has changed greatly the operating schedules of the mills. Urgent calls have been received for rails, rolling stock and shell steel, and, temporarily, some home needs, even cars for our own roads, may have to stand aside.

The details of the \$5 a ton concession on implement steel are being arranged. The cold-rolled shafting schedule was arranged in a New York meeting last week.

Last year's heavy accumulations of export steel at Atlantic ports waiting for ship room were cut down 700,000 tons in the first seven months of this year. Mills have been urged to build up stocks for France at seaboard against the railroad blockades of winter, but thus far have fallen steadily behind the ocean movement.—*Iron Age*.

Coffin Protests to Congress

(Continued from page 360)

eration to the contents of my letter of Aug. 14, to the end that both the Senate and the press may be informed as to the correct status of the three organizations involved in the governmental aircraft program, namely, the War and Navy departments and the non-executive, advisory Aircraft Board.

Much misunderstanding of the situation has arisen because of the dual functions of the officer members of the Aircraft Board, namely, advisory and non-executive when sitting with the board, but executive when functioning as the heads of Army and Navy bureaus. All technical and executive work as to selection of types of machines and their production has by law and by necessity rested until within the jurisdiction of the governmental departments, upon which the civilian members of the board have been dependent for all information and for all contact with military and naval air service progress.—H. E. COFFIN.

Aircraft Contracts Placed

WASHINGTON, Aug. 26—Following is a list of contracts made by the Bureau of Aircraft Production:

August 12, 1918

1867-D. Wright-Martin Aircraft Corporation, New Brunswick, 2000 Hispano Suiza 300-hp. engines.

Curtiss Aeroplane & Motor Corp., Buffalo, plain hexagon head bolts with castellated nuts.

Curtiss Aeroplane & Motor Corp., Buffalo, machine bolts and castellated nuts.

Armstrong Bros. Tool Co., Chicago, Ill., 2400 structural wrenches, 100 C clamps.

Hoosier Veneer Co., Indianapolis, 17,000 ft. walnut lumber.

Pickrel Walnut & Veneer Co., St. Louis, Mo., 40,000 ft. walnut lumber.

George W. Hartzell, Piqua, Ohio, 95,000 ft. walnut lumber.

Des Moines Sawmill Co., Des Moines, Iowa, 500,000 ft. walnut lumber.

Howell & Lesser, San Francisco, Cal., spares for 75 JN4D planes, elevators, landing gears, rudders, wings, etc.

Curtiss Aeroplane & Motor Corp., Buffalo, sets dual controls for 436 JN6H advanced training planes.

Curtiss Aeroplane & Motor Corp., Buffalo, 91 sets dual controls for JN4D planes.

F. A. Requaerth Co., Dayton, 75 gear training models.

United States Aircraft Corp., Redwood City, Cal., spares for 50 JN4D planes, elevators, vertical fins or stabilizers, landing gears, rudders, wings, etc.

Curtiss Aeroplane & Motor Corp., Buffalo, 26 sets upper wings, with ailerons.

General Motors Corp., Flint, 5000 Liberty 8-cylinder motors.

Packard Motor Car Co., Detroit, 100 Liberty 12-cylinder aviation engines.

4465. Norwich Chemical Co., Smethport, Pa., 4500 gal. acetone.

W. S. Gray & Co., New York City, 5000 gal. methyl ethyl ketone.

American Cyanamid Co., New York City, 2350 lb. urea in containers.

Goodyear Claims Its Policies Not Understood

AKRON, Aug. 23—The Goodyear Tire & Rubber Co. in commenting on the charges made against it by the Federal Trade Commission claims that it has not required dealers to sell Goodyear products exclusively nor has it asked them to confine their services to Goodyear tires exclusively. The company has merely pointed out the necessity, from the consumer's standpoint, for this service, and has insisted that dealers upon signing the company's contract undertake to render the agreed service. The company further claims that it has made no effort to curtail, control or restrict the operations of

Contracts

dealers, simply insisting that the consumer must be served.

The complaint of the Federal Trade Commission is based on a preliminary investigation. As yet the Goodyear company is not aware of the nature of the investigation and has not had an opportunity to explain the facts in the case. When this opportunity is presented, the company feels confident that all the items in the charge will be cleared up.

To the company the whole problem gets back to the sincerity of its service station plan and the motive underlying it. The company believes that if the Federal Trade Commission now knew that the whole aim and effect of the company's policy is to aid tire users to conserve tires, get more mileage and hence cut down tire expense, this complaint would not have been made.

Claiming to have based all its policies on thorough investigation, careful analysis and expert legal advice, the company believes that when the facts are known to the Federal Trade Commission the complaint will be dismissed.

270 Airplane Mail Trips

WASHINGTON, Aug. 24—From May 15, when the Air Mail Service was inaugurated, to Aug. 12, when the military authorities turned over the service to the Post Office Department, a total of 20½ tons of mail was dispatched between New York and Washington. This included 270 flights covering 421½ hr. of flying, with a total of only sixteen forced landings. This information was made public to-day in a letter by Postmaster General Burleson to Secretary of War Newton D. Baker, advising him of the completion of the transfer of the equipment and the flying operations of the Aerial Mail Service from the War Department to the Post Office Department.

A Navy Department Contract Placed

WASHINGTON, Aug. 24—The Bureau of Supplies and Accounts of the Navy Department has placed the following contract:

Cadillac Motor Car Co., Detroit, Mich., spare parts.

Two Contracts Are Placed by the Army

WASHINGTON, Aug. 24—The Quartermaster General of the Army has placed the following contracts:

Ford Motor Co., Detroit, Mich., spare parts for cars.

The Goodyear Tire & Rubber Co., Akron, Ohio, tires.

Moline Tractor Notes

NEW YORK, Aug. 22—The Moline Plow Co., Moline, Ill., manufacturer of the Moline farm tractor as well as Moline farm machinery, has placed an issue of \$6,000,000 serial notes on the market, the money being used to fund bank loans which have been incurred to take care of the increased manufacturing activities, stock, raw materials and general expansion of the company.

The notes will bear date of Sept. 1, 1918, and will fall due in six installments beginning with Sept. 1, 1919, and running until Sept. 1, 1924. The notes will yield 7½ to 7¾ per cent interest.

The present capitalization of the company is as follows:

First 7% preferred stock..\$7,500,000

Second 6% preferred stock. 1,500,000

Common stock10,000,000

The company's sales for the 11 months ending July 31, 1918, were \$17,315,036, as compared with \$13,140,450 for the preceding 12 months.

Firestone Sales to Touch \$75,000,000

AKRON, Aug. 26—The Firestone Tire & Rubber Co. estimates its sales will approximate \$75,000,000 for the fiscal year, allowing for the restrictions on the importation of crude rubber and the production of pneumatic tires. The company is devoting its plant to rubberized fabric, balloons and gas masks.

Calendar

ENGINEERING

Sept. 2—Cripple Creek, Colo. American Institute of Mining Engineers.

Nov. 14-15—New York. Society of Naval Architects and Marine Engineers. Twenty-sixth general meeting. Engineering Societies Bldg., 29 West 39th Street.

ASSOCIATIONS

Oct. 7-12—Milwaukee. American Foundrymen's Assn. and 5 allied organizations. Milwaukee Auditorium.

SHOWS

Aug. 29—Laconia, N. H. Tractor demonstration County Farm Bureaus). M. C. Wilson, Director, Agricultural Extension, Dunham, N. H.

Aug. 28-30—West Raleigh, N. C. Tractor demonstration (Farmers' Convention, College Farm). Dr. R. Y. Winters in charge.

Aug. 30—Campton, N. H. Tractor demonstration (Albany Farm). H. G. Gulliver, Mgr.

Aug. 30—Cheshire, Conn. Tractor demonstration (New Haven County Farm). Mr. Harvey, Mgr.

Aug. 30-Sept. 8—Detroit, Mich. Automobile exhibits, State Fair.

Sept. 2-6 — Hartford, Conn. Tractor demonstration (State Fair). Will F. Landon, Secy.

Sept. 2-7—Indianapolis, Indiana, State Fair. Indianapolis Automobile Trade Assn.

Sept. 5—Medina, Orleans Co. Tractor demonstration (State Fair) Food Commission. Calvin J. Huson, Director.

Sept. 8-20—Greely, Weld Co., Colo. Tractor Show, Central Community Fair.

Sept. 9-14—Milwaukee. Milwaukee Automobile Dealers, Inc. Fourth Annual Wisconsin State Fair. Hart J. Ruddle, Mgr.

Sept. 9-14 — Syracuse, N. Y. Tractor demonstration (State Fair). J. Dan Ackerman, Secy.

Sept. 12-13—Marion, O. Tractor demonstrations, Farm Bureau Associations. M. C. Thomas, County Agricultural Agent.

Sept. 17-20—Riverhead, L. I. Tractor demonstration (County Fair). Harry Lee, Sec'y.

Sept. 30-Oct. 4—Trenton, N. J. Tractor demonstration (Trenton Fair). Harry B. Salter, Supt.

Oct. 30-Nov. 4—Shreveport, La. Tractor demonstration. State Fair.

Nov. 11-16—Phoenix, Ariz. Tractor demonstration, State Fair.

RACING

Sept. 2—Uniontown. Uniontown Speedway Assn.

Sept. 7 — Chicago. Chicago Speedway.

Sept. 21—Sheepshead Bay.

Oct. 5 — Cincinnati. Cincinnati Speedway.

Complete Text of Senate Aircraft Report

REPORT RECOMMENDS

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|---|--|
| 1—One-man control of aircraft activities. | 5—Encouragement of invention in aircraft activities. |
| 2—Commission of engineers to go to France. | 6—More protection for aircraft patents. |
| 3—Wider distribution of engine and plane manufacture. | 7—Cost of construction defects be carried by maker. |
| 4—Great expansion of our air policy. | 8—Better fire protection at factories. |

REASONS FOR FAILURE ARE

- | | |
|--|--|
| 1—Ignorance of aeronautical problems by automobile industry. | dominated work entirely too much. |
| 2—Standardized engine program has | 3—Should have more quickly taken up manufacture of European designs. |

MISCELLANEOUS

Criticises severely the patent cross-licensing scheme.

Gives reason for failure of Bristol plane.

Complete information on our flying fields.

Manufacturers' difficulties with tool and jig production not given enough prominence.

Complete information on our plane program, including De Haviland 4, Handley-Page, Caproni, Bristol and other types.

European aircraft engines that we are now manufacturing.

Over 100 different witnesses examined for evidence.

The following is the text of the report of the sub-committee on Military Affairs, which was appointed to investigate aircraft invention in the United States:

Summary

On April 6, 1917, the United States entered the war.

On June 8, 1917, public announcement was made that a great fleet of 25,000 aeroplanes was about to be created, and would be decisive of the war months before an effective army could be put in Europe.

July 24, 1917, Congress appropriated \$640,000,000 to carry out the aircraft program. This fund has been, either by

actual expenditure or by commitments, exhausted. A further appropriation of \$884,304,758 has been found necessary.

In the opinion of the committee a substantial part of the first appropriation was practically wasted.

While much good work has been accomplished, for which due credit should be given, it must nevertheless be admitted that our aeroplane program has, up to the present, presented many aspects of failure. To some of these we call attention:

While an army of three and one-half million has been raised, the aircraft situation is as follows:

a—Six hundred and one De Haviland

4's have been embarked for France up to Aug. 1, 1918.

Of these, sixty-seven had reached the front by July 1.

On Aug. 7 a squadron of eighteen De Haviland 4's flew over the German lines. Details of its performance have not been received. The character and construction of the De Haviland 4 is further discussed in paragraph i and in the body of this report.

b—We have not a single American-made Chasse (or plane of attack) upon the battle front.

c—We have not a single American-made heavy bombing plane upon the battle front.

d—We have not developed and put in quantity production a successful Chasse, or fighting plane.

e—Our attempt to create a fighting plane was centered in an attempt to adapt the Bristol Fighter and the De Haviland to the Liberty motor. The Bristol was, without sufficient tests, put in quantity production, over \$6,500,000 expended, and the lives of several gallant men sacrificed, when the machine was condemned and its manufacture discontinued.

f—The Standard J training machine was equipped with the Hall-Scott engine and put in quantity production. After more than 1200 had been manufactured at a cost of \$6,000,000 the machine thus equipped was condemned as dangerous and placed in storage.

g—The Spad is a Chasse or fighting plane of the highest type. Early in September an oral order was given to the Curtiss Aircraft Co. for the manufacture of 3000 of these machines. Work was at once begun and drawings practically completed.

On Sept. 27, Colonel Clark and Major Vincent (one of the inventors of the Liberty motor) concluded that the machine could not be operated with a Liberty motor.

On Oct. 8 the contract was canceled, the reason given being that the single-seat fighter was regarded as obsolete. But the fact is that on April 23, 1918, a contract was let to the Curtiss company to build 1000 single-seat fighters, known as the S. E. 5, which is the English equivalent of the French Spad.

In addition to this, our Government is now using upon the battle front every Spad machine it can secure from the French, but has only been able to obtain about 418 of them.

i—The cancellation of the Spad contract and the failure of the Bristol left us without either a single or a two-seat fighter, except the De Haviland 4, which was originally designed as a two-seat fighter and which we are equipping for reconnaissance, photographic, bombing and fighting purposes.

Contracts for 8500 were let at various times. Up to Aug. 1, 1000 had been delivered, and a number forwarded to General Pershing. An inspection and test developed numerous mistakes, both in design and workmanship. Work upon the planes was stopped until the defects could be remedied. In part this appears to have been accomplished in the field, for a squadron of eighteen planes has been sent across the German lines.

k—As early as the month of October, 1917, we were in possession of the necessary facilities to construct the Caproni, a powerful and successful heavy bombing plane, approved both by Italian and English aeronautical engineers.

Expert Italian engineers have been upon the ground since the month of January, yet the fact remains that we have up to date constructed only one experimental machine which is equipped with Liberty motors.

Nearly a year has elapsed since we might have begun work upon these ma-

chines and by this time have been in quantity production.

l—The Handley-Page heavy bombing machine furnishes another example of delay. Plans were furnished the Signal Corps in the summer of 1917, but were not then availed of. Contracts for spare parts were not made until February, 1918. Deliveries of these spare parts did not begin until August, 1918. A sample plane ordered in March, 1918, was flown last July. Tests are not yet complete.

Causes of Failure

In the opinion of the committee the disappointing results above set forth are chiefly due to three causes:

I. That the airplane program was largely placed in the control of the great automobile and other manufacturers, who were ignorant of aeronautical problems.

II. These manufacturers undertook the impossible task of creating a motor which could be adapted to all classes of flying craft. It is not too much to say that our airplane program has been largely subordinate to the Liberty motor.

III. We failed at the beginning of the war to adopt the common-sense course of reproducing the most approved types of European machines in as great numbers as possible. This should have been carried on coincident with the production of the Liberty motor. This sound policy has very recently, but after a lamentable lapse of time, been adopted.

One-Man Control

The mistakes and errors referred to would probably have been largely avoided if the aircraft program had been under the control of one man, assisted by skilled aeronautical engineers and practical flyers to design and test our machines, with production made subordinate to them.

This brief summary is not a wholesale condemnation of our aircraft program. Much has been accomplished. The committee is glad to report that while it believes there are yet many things to be remedied, nevertheless we are approaching a period when quantity production of planes may soon be hoped for.

The Aircraft Board

As originally composed, representatives of the automobile industry featured this organization, presumably due to the theory that aircraft engine and plane production were analogous pursuits. The latter was therefore submitted to the custody of men skilled in automobile production. A board thus equipped naturally depended upon motor-car engineers and manufacturers for the solution of aviation problems. But the analogy between the two pursuits virtually begins and ends with the fact that each uses a gas-explosive motor. Hence difficulties in design and production would tend to increase until such conditions were recognized. This fact must have been demonstrated to the board through its initial experiences, for Major Downey states that in the beginning the board wanted much authority with little responsibility.

"They wanted the Signal Corps to

execute contracts and stand back of them, the board to be in an advisory capacity, and still control the situation."

Later, when—

"They saw the crash coming the board passed a resolution reaffirming the fact that they were only acting in an advisory capacity."

Organization under the Aircraft Board was unsystematic and ineffective. The chief officer of the Signal Corps was the nominal head, under whose ostensible supervision bureaus of engineering, equipment, supplies, lubrication, production, etc., were established, many of whose functions ill defined, conflicted with or overlapped each other. Contractors, inventors, material men, everyone having business with this part of the service and directed from one official to the other could not well transact their business and secure results with directness and efficiency. While this condition seems to be inseparable from official business routine in Washington, it featured largely in aviation from the start, materially hindering production on the one hand and diffusing responsibility therefor upon the other. Fairness, however, requires the statement that the identification by Congress of aircraft production and administration with the Signal Corps was unfortunate. The primary needs and importance of that corps as then defined were fully equal to the experience and efficiency of its commanding officer.

How Italy Started

When Italy entered the war she made a careful study of aerial warfare upon the French front as then developed. Her engineers then selected the most efficient types of French flying planes and immediately put them into production under the supervision of skilled French artificers. Coincident with this policy she began the development of airplanes on her own account. Her armies were, therefore, rapidly equipped with an excellent service, afterward supplemented by machines equally effective, but of Italian design and driven by Italian motors. By this means she avoided delay in production. She also promoted the development of her engineering genius by employing it under practical conditions upon the front with the best machines that France had produced.

The Bolling Mission

Your committee does not understand why the Aircraft Board did not adopt this obviously essential policy. The Signal Corps dispatched a commission to the front, headed by Colonel Bolling, instructed to secure all needed information, evidently for that purpose. Col. E. V. Clarke, the aeronautical engineer of the commission, made an elaborate report, having Colonel Bolling's approval, recommending the production of three English, two French and one Italian plane, but the report was not heeded. Designs for these and other types were placed by the allied Governments, or by the inventors themselves, at the board's disposal, with assurances of expert aid to their vigorous construction.

An ostensible reason assigned for the board's inaction was the difficulty of translating metrical into linear measurements, and of obtaining quantity production of foreign motors. But the tardy acceptance and manufacture of some of the models and designs revealed the imaginary character of this objection. The board took some of the planes placed at its disposal and attempted with ill success to materially change them for American production. The general purpose of the changes seems to have been designed to adapt them to the Liberty motor, but this normal action should have been paralleled by their manufacture, both as to plane and engine, in strict accord with the plans as submitted.

Planes for Liberty Engine

Ultimately, and in the autumn of 1917, the board adopted one French and two English types of fighting planes to carry the Liberty engine. These were the Spad, the Bristol and the De Havilland 4. Colonel Clarke was instructed to redesign the Bristol upon the English model, retaining its wing load of about 7.1 lb. in a total weight of 2937 lb.

Hundreds of changes afterward made in this design by Signal Corps and production engineers without consulting Colonel Clarke increased the wing load to about 9.2 lb. per foot, with an approximate weight of 3700 lb. Some of these changes were required by the increased strain of the heavier and stronger motor upon the structure. The machine was finally put into production and then abandoned after the test of July last, and after an expenditure of more than \$6,500,000 and the loss of several valuable lives.

The overload placed too great a strain upon the wings, and this, with bad construction, compelled the board to stop production. The money loss may be partly recovered by salvage. The loss of life and of months of precious time through the need of substituting another type of plane for the Bristol and then producing it are matter of far more serious concern.

The Spad Contract

In September, 1917, the Signal Corps contracted with the Curtiss company for 3000 one-seated Spad planes. This is an excellent French biplane, then and now in use on the front. In October the contract was canceled, the reason given therefor being that it was done at the direction of General Pershing. Inasmuch, however, as General Pershing's cablegram concerning the subject bears the date of Dec. 14 following, we must accept the statement of the Curtiss company's officials that the board canceled the contract because it desired to equip the plane only with the Liberty eight-cylinder motor, which was found impracticable. The Liberty 8 was about that time discarded.

The plane was too light for the Liberty engine, so its production was suspended. The French use the Hispano-Suiza motor with this plane, and the Curtiss people assure us that their contract would long ago have been completed and the planes

in the service at the front had the manufacturers been permitted to proceed with production. No attempt was thereafter made to manufacture single-seater fighters, ostensibly because of the Pershing cablegram, until May last, when Mr. Ryan placed an order with the same company for 1000 SE5 planes. This is substantially the English equivalent of the Spad and will probably be in production during the coming autumn. It is manifest that if the manufacture of the SE5 is proper at this time, then the discontinuance of the manufacture of the Spad was a mistake, regardless of who is responsible therefor.

The plans for the Caproni and the Handley-Page bombing machine were available to the board soon after our entry into the war.

The Caproni Episode

Early in the summer of 1917 the Standard Aircraft Co. was instructed to hold its plant at Elizabeth, N. J., in readiness to build Caproni planes.

About Sept. 15 a verbal contract was made with the Curtiss company, formally confirmed on Oct. 8, 1917, to build 500 Caproni planes. This contract was never carried out, because no information was furnished to the Curtiss company, although it repeatedly endeavored to secure the same. Afterward it was canceled, and contract for the Bristol Fighter was substituted.

As early as October, 1917, at an international conference in Paris concerning a general aviation program, the Italian inventor, Caproni, was summoned to meet Colonel Bolling, one of the heads of the aviation section in Paris. An arrangement was ultimately made by which Captain D'Annunzio and a force of workmen and engineers were to be brought to America to produce in American plants Caproni machines. Captain D'Annunzio and nineteen of the best men of the Italian factory arrived in the United States on Jan. 17.

In January, 1918, the Standard company was given a verbal order for 1000 Capronis, fifty to be assembled and 950 to be sent overseas knocked down. Drawings were prepared, but no official order was given for the machines.

On Jan. 25 Captain D'Annunzio and his men came to the plant, began work on a hand-made machine. A witness describing the transaction states that—

"They (the aeroplane authorities), in February, began to back and fill on whether they were going to build Capronis in quantity, and by March 2 it was practically settled that they would not build Capronis in this country at all, except the ones we were working on and two or three for experimental purposes.

"As a result of that we took the Handley-Page as a substitute."

Captain D'Annunzio states that he had expected upon his arrival in this country that everything would be ready. "They were wiring and cabling Italy, asking for the engineers of the Caproni plant. I requested General Tozzi, who is head of the Purchase Mission in Washington, to help me clear up the matter. So we pro-

voked a lot of meetings between myself, Colonel Deeds and some other officers. * * * It was just the same as before, because no decisions were reached. * * * I found they were undecided as to whether they should make that machine, although demonstrations had been given before the European Military Mission," etc.

Finally Captain D'Annunzio was authorized to build the first experimental machine for American engineers. That machine was finished and flown on July 7. In the meantime, and about April 12, the Fisher Body Co. obtained an oral contract for 250 Capronis, which was later canceled. Again, about May 18, 1918, the Curtiss Aeroplane Co. was given an order for 500 Capronis, and on the same day the Fisher Body Co. was given an order for 500 Capronis. It is understood, however, that nothing will be done to carry out this order until the experimental machine has been tested out. This precaution is proper.

During the interval of delay both of the Italian pilots who came to this country were killed in other machines, and the Caproni program is now awaiting the arrival of Italian pilots and the testing of the experimental machine.

Over 12 months of time has been thus consumed since the Caproni came under serious consideration.

Handley-Page Offer

Plans for the Handley-Page machine were supplied to the Signal Corps in the summer of 1917 by the owner, with full permission to use them. Its engineers made a number of changes in them, beyond which nothing was done with them. Hence, the representative of the owners in the early winter demanded their return. They were delivered to him as changed.

In February last contracts for 1000 sets of parts, afterward reduced to 500 sets of parts, were made with various contractors, to be assembled in Great Britain for the use of the American Army. From 60 to 90 days are required for the assembly of a Handley-Page machine. Twenty of these have been embarked, and we are informed that they will continue to go in constantly increasing quantity, reaching 140 for the month of February. Had these contracts been let last October they could have been completed and delivered by the 1st of July.

One sample machine constructed by the Standard Aircraft Corporation was completed and given its initial flying test on July 6 last. If further tests prove satisfactory the design will go into quantity production. Had the machine been ordered last summer it should be in quantity production now.

1200 Planes Discarded

The production of training planes has been fairly adequate. One type, the Standard, of which there were 1200, has recently been discarded because the Hall-Scott engine which drives it has proven unsatisfactory, but there is no reason to apprehend that training plane production will fall below the requirements of the

service. The designers and manufacturers of this plane insisted that with a good engine it is all right, and this insistence will be tested. If successful they can be made available hereafter. But General Kenly and his assistants found them highly dangerous because of the motor and ordered their retirement. The machines cost the Government about \$6,000,000.

The De Haviland 4

The De Haviland 4 is the only so-called fighting plane now in actual production. Outstanding contracts call for 8500 of them. They are being manufactured by the Dayton-Wright and the Fisher Body companies, with smaller contracts to the Standard and one or two other producers. On August 1 a total of about 1000 of these had been delivered, all but a few of which had been turned out by the Dayton-Wright concern.

The first plane of this type was embarked for France during the latter part of February of this year, but never reached port. Up to July 1, 286 had been shipped abroad, of which 67 had reached headquarters in France. On August 1 601 had been embarked. A number of them were delivered to Gen. Pershing's headquarters in June, and upon inspection were found to contain many defects, some of which were serious, others of less importance. Under date of June 26 General Pershing cabled the War Department enumerating many defects and stating explicitly that the machines could not be used until some of them were corrected. Also that all planes of this class should be thoroughly tested and inspected before being shipped to him. This obvious requirement General Kenly had insisted upon observing, but sent them over in the instance considered without doing so, because of an overseas order requiring it.

Defects in De Haviland 4

Some of the defects enumerated in this report, in the opinion of every expert flyer who has been examined by the committee, rendered the machines more than ordinarily dangerous. Their opinion differed as to whether or not corrections can be made to make the machines safe, but the assertion that the plane is very unsafe in the condition in which it has been up to this time delivered from the factory was practically unanimous. Deliveries of the machine continued notwithstanding, and many were sent to France in precisely the condition complained of in Gen. Pershing's cable. The explanation offered for continuing delivery of these defective planes is that the corrections could be made overseas, and a force of American officers and mechanics under command of Lieut. Col. Hall was dispatched to France about the middle of July with orders to make them. Your committee is of opinion that the planes should never have been permitted to leave the factory in their defective condition, and the fact that they were permitted to go shows either a lack of appreciation of the situation, a disregard for it, or a very poor system of inspection. On August 2 an order was issued

to all the factories directing that no more of them be delivered until the corrections required were made. We are informed that production under these new conditions is about to be resumed.

In July 155 of these planes were delivered to the Navy, about 50 of which were shipped abroad and approximately 100 crated and delivered at the seaboard for shipment. At this stage four of them selected from the lot were sent to the Navy testing field at Miami, Fla. A test and inspection there revealed the same defects that were reported by General Pershing and some others. The commandant, Capt. McCaughtry, immediately reported this fact to the Navy Department with the result that a cable was sent to Admiral Sims apprising him of the defective condition of those previously sent, while the 100 in crates at the port of embarkation were rejected and returned to the Aircraft Board.

Forty De Haviland 4's sent to a Long Island Field about this time and tested out in the vicinity of New York were pronounced structurally weak and defective. With the production of the De Haviland 4 it has been the same story of changes. Many of these have been made in the plane since the board determined upon its manufacture. Some were unimportant, some extremely so; many of them undoubtedly necessary to its adaptation to the Liberty motor. But they have been made for the most part by automobile and mechanical engineers, having little or no experience in aviation engineering.

54 Perfect Machines Delivered

On the 28th, 29th and 30th of July three squadrons of 18 machines each, 54 in all, having been overhauled by American and French mechanics at an American aviation base behind the French lines, were delivered to the front under their own power. These planes are said to have received the approval of Capt. de Haviland after a careful inspection. Assuming this to be true, it indicates that the machines sent over have been carefully inspected and the defects remedied. On August 7 one squadron of these, comprising 18 machines, under command of Gen. Foulois, made an expedition across the German lines and returned in safety to their base. This marks the date of the use of the first American-built plane over the enemy's lines. The committee has no information regarding the character of their performance.

The character of the evidence concerning this machine, ranging from qualified approval to severest condemnation shows that the De Haviland 4 is chiefly available for observation or reconnaissance purposes. That the War Department and the Aircraft Board share this view is best evidenced by the fact that it is to be replaced by a machine of later design as speedily as may be possible without complete suspension of production.

With the exception of the S. E. 5 and the Handley-Page, in parts, no other type of fighting plane can be produced in quantity before 1919.

The U. S. D. 9 plane is a redesign of

the British D. H. 9, being a great improvement on the D. H. 4. But the U. S. D. 9 has not yet fully responded to the tests of the military bureau and will go into production only when it does so. The U. S. D. 9A, another and later design, now under test, promises to be a satisfactory machine. If the promise is fulfilled by the test, the design will be adopted and substituted for the De Haviland 4.

Recognizing the fact that the United States would not produce planes in quantities early in the war, the board contracted with the English and French early in 1917 for a supply of fighting planes. Of these 2,114, according to the latest testimony we were able to receive, have been from time to time delivered. This enabled us to maintain 13 squadrons of 18 fliers each on the front, a force which is wholly inadequate to meet requirements of modern warfare. It should also be stated that as our troops are moving to France in great numbers, the disparity may increase until we get into quantity production. It is proper to call attention to the fact that at an investigation of the War Department by the Military Committee, held in January and February, 1918, the committee was assured that the French could and would furnish all the combat planes we needed, provided we would send them the raw material, and that this material was being furnished. This assurance was given when the committee showed anxiety at the continued delay in the shipping of planes.

In January General Squier and Colonel Deeds testified to this fact and Secretary Baker gave similar assurance to the committee. The facts, however, are as shown by the testimony of General Kenly, given on July 20, that the plan failed for two reasons. We quote his testimony:

The French contract practically fell down, as you know. * * * It was due to what I consider two reasons. In the first place, the contracts with the French were dependent upon the sending of raw material that was to be furnished by us, and we did not live up to our agreement. * * * In the second place, the increase in German activities in the air caused a change of program in French aviation construction. * * * The French contracts fell down, so that we became more or less dependent upon what could be furnished on this side.

Besides this, many of the machines our men are now forced to use in France are unsatisfactory, but not more so than those used by the French themselves. An Army officer recently at the front testified that the American troops are using many antiquated machines purchased from the French that were discarded by them a year and a half ago. They are using the Sopwith 1½ strutter, which has been declared unsafe by the French and British for observation work. They are using the A. R., equipped with Renault 220, which has a ceiling of only 10,000 feet. They use a Spad two-seater, which is unreliable and unsatisfactory. They were using a few French Briquet machines and the Sampson, which is a

French machine. It is therefore reassuring to reflect that all commands are unified in France, with all lines of the service under a common protection.

Praises Liberty Engine

The Liberty 12-cylinder engine is an excellent one for the heavier planes and certain other purposes. Its weight of 825 pounds and its 400 horsepower makes it too heavy and too powerful for the lighter types. It is not yet perfect, but it is improving under repeated tests and experiments, which disclose defects for elimination and suggest changes and readjustments of its parts. It is now in quantity production, more than 4,000 having been delivered, and it is approved by our allies, who are anxious to obtain more of them than we can at present supply.

In the development of this motor the Aircraft Board has performed an important task, for which due credit should be given. But the announcement that it had been evolved in a few days was unfounded, and the notion which was encouraged that it could be used for planes of all sizes and character was largely responsible for delays to our plane program.

Motor production has proved to be a formidable task, magnified in some degree by the reluctance of the designers to promptly accept and act upon suggestions of imperfections from competent engineers and critics and fliers and make changes in conformity with them.

Making Foreign Engines

The manufacture of the best foreign motors, among which are the Rolls-Royce, Hispano-Suiza, and Fiat, contemporaneously with the development of an American engine would have been the sounder policy. That it was partially adopted later confirms this conclusion. We are doing what should have been done a year ago and are producing a 150 and 180 horsepower Hispano-Suiza motor in quantity. Deliveries of the Le Rhone, Bugatti, and 300-horsepower Hispano-Suiza will follow.

American concerns are making the Rolls-Royce motor for the British Government and should long since have been making them for ours. The smaller types of Hispano-Suiza are serviceable for the lighter and faster planes. In view of these conditions, the apprehension of a year ago that we could not produce foreign motors in quantity because of their metrical measurements and intricacies of construction, requiring manual instead of machine work, which we did not possess, becomes untenable.

No fighting plane of American or other design has been built around the Liberty engine, although it is an axiom in aeronautics that planes must be adapted to motors. The Aircraft Board authorized some attempts at this all-important work, one by Capt. Le Pere and one by Col. Clarke, the first of which is being tested and developed by the board, with good prospects of success. This should have been done before, as the type must be made effective before the best performance of the Liberty motor can be secured. A Curtiss design also gives promise of

satisfactory results in the near future. The motor can be used in some other models with good results, but until a Liberty plane is successfully built around a Liberty motor by competent aeronautic engineers and thoroughly tested out our air program will not be complete.

Poor Inspection System

The Signal Corps inspection system has paralleled that of the producers. In some instances it has functioned badly, with the result that defective material has at times been accepted and material condemned and reported to chief inspectors has found its way back to the producer. In some factories the finished product has been accepted, although not up to requirements. Generally speaking, the production and inspection systems of the manufacturers seem to be more co-operative than competitive. We have found no collusion between the official and the private inspector, but the inspection in the past has been bad. The faults of the system are in part due to the incompetency of the inspectors. We are informed that the system has undergone and is now undergoing a radical transformation and is being remedied as rapidly as skilled and efficient operators can be secured.

Our Training Fields

The training fields are each designed for 600 enlisted men, 300 cadets, and 72 officers, a total of 972 men, which, owing to the exigencies of the service, have at times been exceeded. This arrangement requires a total of 54 structures of all sorts for each standard field. In addition to these, there are repair and supply depots, balloon schools, experimental stations, radio laboratories, warehouses, quarantine camps, temporary barracks, photograph schools, etc.

Up to May 25, last, there were 31 fields, including balloon schools and experimental stations, and 37 miscellaneous projects comprised in the above recital, not including the training schools at various State and other universities, nor projects recommended but not yet approved by the War Department. Their estimated cost is \$52,511,134, of which \$39,356,407 have been expended, exclusive of a field at Miami, Fla., established by Co. E. A. Deeds, a member of the board, on his own responsibility (and without the knowledge or sanction of the head of the equipment division having charge of the work), and a night flying route from Dayton, Ohio, to Rantoul, Ill., by way of Indianapolis. The cost of these extra projects was over \$400,000. This night flying route was used for the first time on the night of August 12 between Dayton and Indianapolis, and was pronounced satisfactory by Gen. Charles E. Lee and Capt. J. Fitz Morriss, of the British air service, and the aviators who made the trip.

The Equipment Division had some difficulty in securing material for construction prior to the advent of Mr. W. C. Potter, now assistant director of the Production Board, since which time there has been much improvement.

The contractors for the work at Lang-

ley field and the fields at Dayton were not satisfactory. Upon the whole, the work of construction proceeded fairly well and the structures on most of the fields have been completed.

Langley Field, near Newport News, Va., consisting of 1,650 acres, was selected prior to our entry into the war for a training and experimental field. The estimated cost of its needed buildings, not yet completed, is \$3,664,050, of which \$2,305,697 have been expended. It seems to have been wisely chosen and well fitted for testing and experimental work.

Dayton's Flying Fields

Nevertheless, it was practically abandoned last year for that class of work, and McCook Field, at Dayton, Ohio, consisting of but 200 acres, and practically inclosed by river, trees, and telephone and telegraph wires, was selected instead and leased at an annual rental of \$12,500. The reason assigned to the committee for this change was the lack of transportation facilities at Langley, although a spur connecting it with nearby railway systems had been constructed by the Government for its express accommodation prior to the transfer. The insufficiency of this reason is emphasized by the fact that about the same time the board selected the Wilbur Wright training field, near Dayton, requiring the construction of a trolley line by the Government, at a cost of \$175,000, which is its only line of transportation. The field is now being used by the Bureau of Aeronautics for its military testing plant. McCook Field is not only too small for satisfactory experimental flying, but its environment is unfavorable to its use for that purpose. The board has, however, equipped it with structures costing \$920,100.

Adjoining the Wilbur Wright Field is a large warehouse, built at a cost of some \$500,000. In this warehouse are stored great quantities of supplies, many of which, like machine guns, radio batteries, photographic accessories, etc., are manufactured in the East. To send them hundreds of miles west for storage, re-shipping them over the same route back to the seaboard when needed for overseas uses, is waste. It needlessly adds to railway congestion and should be corrected.

Your committee visited but a few of the training fields, of which Wilbur Wright Field, above referred to, was one. It comprises 2,200 acres and belongs to the Dayton Conservancy Association, and is designed as a part of the bed of a great reservoir to hold back the flood waters of Mad River. Much of it is low and swampy, either on a level with or slightly above the normal level of the stream flow. Any considerable rainfall floods a great portion of it and a rain of 36 hours last March caused an overflow of nearly 2 feet above the floors of the hangars, thus seriously threatening the planes with damage and suspending training completely. A drainage system, since installed, is said to have improved this condition, but your committee is informed that the Signal

Corps was advised by competent authority against locating a field upon these premises because of its low and marshy character, and the judgment of the officers and fliers at the field and familiar with the ground was a unit against its adaptability. An excellent stretch of ground within 4 miles of this field, traversed by railway and high above the river level, admirably drained by nature, was available to the board when Wilbur Wright Field was selected.

The large sums expended upon the Dayton-Wright Field, amounting to \$2,878,699, and requiring an ultimate total of \$3,097,777, and its use for testing purposes, probably demands its present retention if the drainage system referred to shall prove fairly effective. But when the dam is completed—the reservoir is to be filled—the buildings must be removed, or they will otherwise be submerged.

More recently the board, desiring an additional field near Dayton, was offered an acreage adjoining the Dayton-Wright Airplane Factory on the east. Inasmuch, however, as insistence was made that the lease be executed to the Dayton-Wright Co., as lessee, for the use of the board, the rental to be made an item in the cost of airplane production, the representatives of the board very properly declined the suggestion, and the project is still incomplete. We feel obliged to note in this connection that shortly before negotiations for the McCook and the new field, Col. E. A. Deeds, a member of the Aircraft Board, was the owner of the first and a part owner in the second. He sold and transferred them to interests with which he had been identified, and which now own them.

Aviation Contracts

At the outbreak of the war but few concerns were engaged in airplane and motor construction; but there were concerns devoted to other pursuits, and potentially capable of producing both in quantity if encouraged to do so. The need for planes in volume, and as rapidly as possible, prompted Congress to make the largest single appropriation for the Signal Corps which up to that time had ever been made. Since then our engine-producing capacity has been fairly enlisted, while that of plane production has not been properly encouraged. A number of plane manufacturers, like the Wittemann-Lewis Co. of New Jersey, and in the business years prior to the outbreak of the war, have been unable to obtain contracts; while a number of concerns like the Dayton-Wright Co. and the Standard Co., have been practically organized since the war, and the former was given enormous contracts before its factories were completed.

Companies assured of capital and factory space have been denied contracts because they were not going concerns, while other companies in similar condition have received contracts, notwithstanding their present lack of producing equipment. No one official controlled or supervised the making of agreements or their execution. Beginning and ending with the Aircraft Board, the head of production,

the director of supplies, the head of the contract section, and perhaps other links, made up the chain of procedure. Adopting models of proved efficiency, and then putting all responsible producers at work upon them, would, in the opinion of your committee, have greatly expedited, as it would have guaranteed, the performance of the aircraft program.

Money for Makers

To aid in the construction of the Dayton-Wright plant and the Elmwood plant of the Curtiss Co., the board made generous advances of money, and to them was given the task of making and supplying other contractors with plans, designs, blue prints and specifications for the accepted types of machines, exclusive of bombing planes. This gave these concerns great advantage over their competitors, which thus became dependent upon them for material without which the work of production could not begin, and when begun was subject to suspension and delay, with changes in construction and design. Moreover, the Curtiss Co. exacted a fee for copies of plans, etc., of 1 per cent upon the contract price from other contractors, which, although added to the cost of production, was paid to the Curtiss Co., adding a considerable aggregate sum to its revenues.

The number and amount of contracts for planes and motors assigned to concerns at Dayton and Detroit, and the number and character of aviation fields at Dayton could not fail to attract the attention of your committee. Due to her vast automobile industry, Detroit doubtless possessed greater facilities for gas-engine production than any other American community, and the Fisher Body Co. was well equipped for the manufacture of planes in quantity. A generous recognition of these facts was therefore inevitable.

But Dayton possessed no such advantages. Her manufacturing interests were for the most part in other directions. Industrially considered, the concentration of the greater part of the new pursuits in these two cities may perhaps be justified, but the committee is forced to the conclusion that the personnel of the Aviation Board, from its formation to its reconstruction, explains the fact.

Blames Aircraft Board

The civilian personnel of the board, and their more prominent subordinates, were composed of gentlemen a very considerable number of whom lived in these cities, and before or at the time of entering the Government service were leaders in and identified with the industrial development of their respective communities. The divestiture of their interests by transfer to others was a laudable though essential step toward qualifying them to public service, but the granting of major contracts to old associates, the transfer of the experimental station from Langley to Dayton, and installing it upon an inadequate tract quite recently the property of a member of the board, the tender, and qualified acceptance, of a second field formerly owned in part by the same member, the selection of the

Wilbur Wright Field, physically and geographically unsuited for the purpose, and the giving of huge contracts for airplanes to a corporation created since the war began, of which he was one of the first officers, and owned exclusively by his former partners and business associates, have provoked, and we think justly, much of the public comment which made the investigation imperative and much of the resentment of less favored manufacturers in other localities. It is also a distinct argument for those who assume to fear, and who assert, that aviation, through the board, is to be made the subject of ultimate automobile control. This feature of the subject is, as heretofore stated, under full investigation by the Department of Justice.

Against Cross Licensing

Although this subject has been referred to a special subcommittee for investigation, it has constantly obtruded itself upon our attention, hence we can not avoid referring to it.

The National Advisory Committee of Aeronautics, confronted with the necessity of satisfying the claims of patentees and avoiding possible delays threatened by conflicting patent rights, determined upon mature consideration to settle these difficulties through the agency of a Manufacturers' Aircraft Corporation, to be composed of those engaged in the industry and empowered to license all aircraft contractors, who should pay a royalty to the company upon all planes and parts to be constructed and to assign to the company for the common use all patents or applications therefor owned or controlled by the licensees. The bulk of these royalties was to be paid to the Curtiss and the Wright-Martin Cos. as compensation for the use of certain patents until each had received \$2,000,000. These were to be charged against cost of production and paid by the Government. The agreement was sanctioned by the Department of Justice and approved by the Secretaries of War and the Navy.

The committee has not heard a word in approval of it. It is condemned by every airplane manufacturer outside of the immediate beneficiaries. Those executing the license agreements have done so under protest because the Aircraft Board recommended or required it.

Criticisms of it are numerous, the most serious of them being that it subjects manufacturers to onerous requirements by its beneficiaries, such as assessments for the use of plans and specifications, the purchase of the material and accessories from favored houses the assignment and surrender of valuable patents and patentable devices of the Aircraft Association upon terms prescribed by itself, the discouragement of invention, and the inevitable control of the aircraft industry by that association or by some other interest through its agency. Your committee sympathizes with many of these sentiments, and notwithstanding the Aircraft Production Board as now officered no longer requires or recommends the execution of the agreements

by contractors, we believe the arrangement should be abrogated. We regard it as vicious and as designed to reap large profits by taking advantage of the necessities of the Government. The basic patentees should, of course, if the patents are valid, be compensated, but this should be done by the Government directly whenever the courts finally determine who the owners are and the patents should then be made free to all manufacturers.

New patents of meritorious character should be similarly acquired by the Government as they appear. Such a course would stimulate invention and promote the development of an art which is still in its cradle.

This is not a new departure but rather a reversion to an original policy, for Congress in 1917 appropriated \$1,000,000 for the purchase of aircraft patents, which sum is still available, and if insufficient for the purpose it can be easily increased. The Government should never be made the victim of a patent monopoly which it generously created for the sole protection of the inventor against infringement by persons and corporations.

Production Difficulties

Much can be said in extenuation of the disappointments encountered in aircraft production. The industry is new and highly technical. Mechanics skilled in the art were few when the war began, and of aviation engineers there were scarcely any. Production capacity was undeveloped, and even planes for training were not immediately obtainable. Up to January, 1917, only 118 airplanes of all types had been delivered to the Army, 64 of which were made in 1916, and there was no aircraft organization either in the Signal Corps or out of it. The Bolling Commission was not sent to Europe until June, and its report was not received until September. But for the glowing forecast and optimistic announcements which the board and others made to the public from time to time regarding its actual and prospective performance, and the certainty of speedy and unlimited production, public disappointment would not have been so pronounced nor public resentment so widespread. Great Britain in 1915 and 1916 experienced delays, miscarriages, and expenditures. Instead of profiting by her experiences the board incurred similar ones and accentuated them by representations and assurances which were not warranted by the actual facts.

The order of the President creating a Military Bureau of Aeronautics and a Director of Aircraft Production and the appointment of Gen. Kenly and Mr. Ryan as the heads of the two divisions is an improvement upon the previous situation, and a number of the conditions we have criticized have been or are in the process of being corrected and better methods instituted. For example, a single board of engineers formed by combining the technical and production engineering sections and headed by a chief selected by Mr. Ryan, with the approval of Gen. Kenly, has been established; one testing

board under the command of a single officer has succeeded the double system formerly doing the work. The Military Bureau, under agreement with the director, after thorough experiment by actual fliers and aeronautic engineers, now determines the character of machine to be produced, and the business of the director is to produce it.

Committee Recommendations

1.—The inspection of the finished product and other material is now the work of Gen. Kenly's division and is to be done by thoroughly competent officers. Work not satisfactory to Gen. Kenly or not up to the requirements of his Bureau is rejected. Co-operation for the common end has been, and we hope will be, observed by the heads of the two divisions and required from their subordinates. The loose ends of the former organization have been gathered up as rapidly as possible, and the results of the improved conditions are already apparent in some directions. But the system is still subject to the criticism that it is dual in character, which is unsatisfactory, since it may at any time lead to differences and to division of responsibility. We are constrained, therefore, to renew the committee's recommendation of last April, sustained by the opinion of every man whose views were consulted by us; that the whole subject should be under the control of one man. Our present organization is faulty because divided into two parts with a man of strong will and opinion at the head of each division. While these two divisions are correlated, they may not be permanently co-ordinated. Your committee therefore believes that the importance and magnitude of aviation as a permanent branch of our military organization requires one directing and responsible head both for its efficiency and speedy development. Its classification with the Army and Navy as a distinct arm of the service is essential to this end.

Of comparative insignificance at the outbreak of hostilities in 1914, aviation has become indispensable in modern warfare. Without aircraft no army can any longer hope to triumph or, indeed, to escape inevitable defeat. Without aircraft the most powerful navy must in these days remain upon the defensive. The aircraft force of Great Britain and France each outnumbered the regular army of the United States when we declared war, and ours should soon be as large as theirs. It is a distinct arm of the service. Great Britain and France, recognizing its supreme importance and the need of its swift expansion, last year each converted it into a department of its own, whose head, as minister of the air, ranks as an officer of the cabinet, who is held responsible for efficiency of production and manufacture and an efficient force of aerial fighters. We should do likewise—create a department of aviation, under the control and supervision of a secretary, and ranking with those of the Army and Navy. We would thus place power and responsibility in the hands of a single man, organize a service

not alone for this war but for all time, and establish for the forces of the air the same policy of administration that has so long governed those of the land and of the seas.

The cost of equipment and maintenance is rapidly approaching that of the Navy, while training for aviation is as distinct and as technical as that for West Point and Annapolis.

The creation of the department of the air would unify the service, thus removing all friction between the Army and the Navy divisions of the service by subjecting both to the control of a common head. Differences between them under present conditions are unavoidable and, while more disagreeable than serious so far, they will arise from time to time, tending to seriously disturb the service, besides interfering with production.

2. A commission of engineers and pilots for observation at the front, formed in relays and reporting in person to the department at frequent intervals, is also imperatively demanded. The betterment of the air service through the exigencies of actual warfare is rapid and important. They should be accurately and promptly reported in detail to the home office, and this can be efficiently done in no other manner. Similar conditions have long been maintained by our allies, whose policy in this regard we will do well to adopt.

3. But your committee feels that the prime need of the hour is machines in continuing quantity, and the production of them should be accelerated by enlisting the constructive activities of all responsible concerns engaged or which can be engaged in the business to full capacity. We cannot, while the war lasts, have too many effective planes. Supremacy of the air means a speedy triumph. We have hundreds of trained pilots waiting for planes, whose services must be postponed for their production.

Planes to be useful must have motors. These too should be in production in every factory that can and will turn them out, due allowance being, of course, made for other equally insistent requirements for ordnance, ships and the like. If this is done, the results for 1919 will then compensate somewhat for the disappointments of the current year.

4. The rapid development during the war of the aeroplane and its effective use as an important arm of the military makes it imperative that America give greater attention to the perfection and production of aircraft. This should be done not only as a war measure but as a commercial and industrial necessity.

The importance of a powerful air force and an abundance of heavy artillery cannot be overstated in bringing the war to a speedy and successful conclusion. With our vast resources in raw material and our facilities for manufacture we can, by the adoption of a broad program and with the assistance of our allies, obtain the complete supremacy of the air.

Without hesitation or delay we must give attention to this expansion of our aircraft policy. The inventive and pro-

ductive genius and energy of America must be devoted to the creation and improvement of new types of aircraft and engines. Our present program must be greatly enlarged. The United States should establish at Government expense college and university courses in aerodynamics and mechanical engineering, in addition to courses for training fliers.

While quantity production is essential to the complete equipment of our armed forces, quality should not be sacrificed to quantity. The aeroplane requires the highest degree of skill in workmanship and the very best kind of materials.

The aeroplane is a product of American genius, but the credit for its development largely belongs to other nations. America should meet this challenge by bringing the aeroplane to still greater perfection.

5. The inventive genius of the nation should be encouraged in the most effective way. A Bureau of Inventions, recently established by the War Department, is a step in the right direction. A persistent complaint, doubtless in a large degree due to the disappointment of men whose devices have not been pronounced practicable, is that under the administration of the old board scant consideration has been given to new devices and suggestions. This seems principally to have resulted from the absence of any well-defined individual agency having full authority to deal with the subject. One man, the designer of a model for a dirigible with a car integral with the Blimp, began with the Advisory Committee and was passed on from one officer to another until he finally completed the circle and was referred back to the committee which started him on his journey. About six months were consumed in making the circuit and nothing was accomplished. A plane designer encountered a similar experience, with the added one that his plane was crushed to pieces in a sand test which was declared satisfactory by those who made it but wholly unsatisfactory by those empowered to make final decisions. Many, perhaps most, of the so-called inventions brought to the notice of the authorities in times like this are of no importance. But if the germ of something new and useful can be detected in one of a multitude of models, the time and energy expended in discovering it will redound to the benefit of the nation.

6—Ample protection should be extended by the Patent Office to applicants for patents for inventions relating to the public welfare and defense. This is demanded not so much for the inventor as for the nation. Authority for this now exists, but it seems to be exercised at times and disregarded at others. Additional legislation may be necessary to make this precaution effective, but in the meantime a suggestion from the Production Board to the Commissioner of Patents regarding applications for inventions relating to aircraft would doubtless shield the application from all publicity, thus assuring its indemnity against disclosure to enemy interests.

7—The margin of profit on some con-

tracts, particularly for motor production, is altogether too high. According to the estimates of the accounting division they appear to be for the Liberty motor at one of the plants 33.6 per cent; for Liberty engine aluminum pistons, 285 per cent on capital invested; for the Le Rhone, 92.8 per cent on cost of production; and on the D. H. 4 plane about 50 per cent. This is largely due to the primary unfamiliarity of officials with the cost of rapid manufacture of novel products in great and urgent demand.

The high cost to the Government having been now demonstrated, we feel sure that future contracts will result in great saving to the Government.

8—Planes and engines rejected because of defective construction or materials not furnished by the Government direct should be at the cost of the producer. Existing agreements require payment from the Government for everything delivered, presumably because they have passed official inspection. But when producers are required under their agreements to bear the expense of an inferior product, on the perfection of which human life is absolutely dependent, their own inspection will be of the best, and good workmanship will inevitably result.

9—Your committee, in inspecting the aircraft plants have noticed the great danger of destruction by fire owing to hazardous processes of manufacture, hasty construction, lack of automatic sprinkler and other fire protection.

The burning of any of these factories in whole or in part at this time would be a catastrophe, for it would greatly cripple the aircraft program.

We urgently recommend that the requirements of the Fire Prevention Bureau of the National Council of Defense, composed of fire insurance experts, for better fire protection in these factories be made immediately compulsory by the Director of Aircraft Production, and that a stipulation be inserted in future contracts compelling a compliance with such recommendations.

Gasoline Conservation Requested

(Continued from page 379)

greater than the July consumption of 1917, while production was 27 per cent greater than in July of 1917.

The request calls only upon the owners of cars east of the Mississippi River because those west of the river are in or close to the production field and are not affected by the transportation problem which is another factor. Transportation east of the river is devoted so largely to war work and to carrying oil and gasoline for shipments overseas that some eastern localities have already encountered serious gasoline shortages.

The Conservation Department of the Fuel Administration points out that there are over 5,000,000 automobiles in use in the United States, and that if each passenger car owner will do his utmost to conserve gasoline, preventing spills, racing of engine, etc., each owner can probably save from $\frac{1}{2}$ to 1 pint per day, which in itself would effect a sufficient saving to meet the excess demand.

The Conservation Department plans to establish oil conservation districts throughout

the country, placing automobile dealers at the head of each district together with committees to be composed of newspaper men, automobile club representative, oil industry representatives, garagemen and dyers and cleaners. These committees will in turn appoint deputies for each county. Huge posters will be displayed everywhere, and all garages and oil stations will be instructed in every means of gasoline and oil conservation. The Fuel Administration is desirous of securing conservation of oil and gasoline without issuance of any direct orders, and is adopting the plan of intensive education for that purpose.

Following is the complete statement by the Fuel Administration:

The United States Fuel Administration considers it necessary that a limited conservation of gasoline be undertaken, in the States east of the Mississippi River in view of the increasing demand for gasoline for war purposes and the paramount obligation of meeting promptly and fully all overseas requirements.

An appeal is made, therefore, to the people of the United States east of the Mississippi River to exercise rigid economy in the consumption of gasoline during the next few weeks as a necessary and practical act of patriotism.

War necessities are being and will continue to be promptly and fully met, but this is the period of the year when consumption of gasoline is at its highest, and the increased domestic demands, together with the extensive military operations in France, have rendered necessary, for a limited period, the adoption of safeguards against possible shortage.

In view of the difficulty, if not the impossibility, of differentiating between the various uses to which automobiles are applied, the United States Fuel Administration believes that the greatest measure of economy can be effected with the least interference with the business of the country through the discontinuance of the use of all classes of motor vehicles, motor boats, and motorcycles, on Sundays.

The United States Fuel Administration therefore requests that in the section of the United States east of the Mississippi River there shall be a discontinuance of use of the vehicles above specified, including all such as are operated for hire, on each Sunday hereafter until notification that the need for such discontinuance has ceased.

Decreases in Bituminous and Anthracite Production

WASHINGTON, Aug. 27—Less than 12,000,000 tons of bituminous coal were produced for the week ended Aug. 17, the first time that production has been below this figure since June 22. The output was 11,910 tons, 379,000 tons less than the preceding week, but 1,597,000 tons greater than in the corresponding week of 1917.

Anthracite production for the week of Aug. 17 was 1,924,000 tons, a decrease of 127,133 tons as against the preceding week, and also a decrease of 63,800 tons as compared with the corresponding week of last year.

The bituminous mines produced 79.7 per cent of their full-time output during the week of Aug. 10. Car shortage was responsible for a loss of 9.8 per cent; labor shortage, 4 per cent; mine disability, 4.2 per cent; no market, 0.4 per cent; all other causes, 1.9 per cent.